

Rotary Care & Maintenance Handbook



Original Instructions

REFERENCE	REFERENCE DESCRIPTION
Rotary Care & Maintenance Handbook	User's Manuals
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GENERAL INFORMATION

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ABOUT THIS ISSUE

This book is the new version of the National Oilwell Varco® (NOV) rotary care and maintenance handbook which has been used over many years. Technology and products have been improved over the years, however, the principles of maintaining the equipment has not. This issue contains information about new products like lifting gear, adapter rings and master bushings. Some information about products which have been discontinued has been removed, like MDP, MDS, KRVS, KRBM, KRP & KRS roller kelly bushings.

This book can be read in conjunction with the Rotary and Handling Tools Catalog (D391000838-MKT-001). It also can be considered to be the User's Manuals according to the Machinery Directive 2006/42/EC, containing all information for safe use, maintenance and repair. Nevertheless it must be said that in case an User's Manual exists, the User's Manual prevails.

THE CARE AND MAINTENANCE OF ROTARY EQUIPMENT

The search for energy continues at an ever-increasing rate. Wells are being drilled daily to greater depths than were thought possible only a generation ago. These deep wells place great demands on both the rig's rotary equipment and the crews that operate and maintain it. The rotary equipment is the very heart of the drilling operation. A lot of drilling operations center around the conventional master bushing, slips, kelly and kelly bushing. Even though this equipment is designed for long service life and is able to absorb a certain amount of mistreatment, it will eventually wear out.

When a piece of rotary equipment fails in use, the results are often dangerous and always expensive.

A planned program of regular inspection and maintenance will save a great deal of rig time and money. The real problem seems to be that rotary equipment on the rig may remain in service for several years without failure, and its performance is taken for granted. All too often, the only time a problem appears is when a kelly turns through a kelly bushing, or when pipe is inspected, and several joints must be discarded due to bottlenecking in the slip area.

The purpose of this handbook is to avoid expensive damage to drill pipe, drill collars, and kellys due to improper handling and equipment maintenance.

Although NOV equipment is shown extensively throughout this handbook, inspection, maintenance, and operating principles are essentially the same for all manufacturers' products.

PATENT INFO

Products in this catalog are covered by (but not limited to) the following patents:

US6,845,814 B2; US6,845,814 B2; US6,845,814 B2; US6,845,814 B2; US6,845,814 B2; WO03060280; US6,896,048; US 6,896,048; US 6,896,048; US4,446,761; US4,446,761; WO2005059299; GB2004/003413; USP 10/734,923; USSN 10/807,642; USSN 60/567,236; WO0052297; EP1475512; US2006005962; US2002074132; US6,443,241; US6,527,493; US6,691,801; US6,637,526; US6,938,709; WO.03/025444; WO.03/054338; US6,845,814 B2; WO0052297; EP1475512; US2006005962; US2002074132; US6,443,241; US6,527,493; US6,691,801; US6,637,526; US6,938,709; WO.03/025444; WO.03/054338; US6,845,814 B2; WO2005045177; US 2005/0077084; WO2005106185; PCT/GB2004/0050001; US No. 60/567,235; US6,845,814 B2; CA1087162; US4,203,182; CA1087162; US4,203,182; US4,446,761; WO 2005/059299; US7,510,006, US. 7,591,304

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LIABILITY

This book is intended to provide general information. Every effort has been made to ensure the accuracy of the information contained herein. NOV will not be held liable for errors in this material, or for consequences arising from misuse of this material.

LIMITED WARRANTY

The warranty will be void if the tools or parts were either:

- unauthorized modified
- replacement parts not manufactured by NOV were utilized
- not properly stored or maintained All PIB's are available from www.nov.com - solutions - drilling Special information

Detailed descriptions of standard workshop procedures, safety principles and service operations are not included. Please note that this book may contain warnings about procedures which could damage equipment, make it unsafe, or cause PERSONAL INJURY. Please understand that these warnings cannot cover all conceivable ways in which service (whether or not recommended by NOV) might be done, or the possible hazardous consequences of each conceivable ways. Anyone using service procedures or tools, whether or not recommended by NOV, must be thoroughly satisfied that neither personal safety nor equipment safety will be jeopardized.

All information contained in this book is based upon the latest product information available at any time of printing. We reserve the right to make changes at any time without notice.

INTENDED AUDIENCE

This book is intended for use by field engineering, installation, operation, and repair personnel. Every effort has been made to ensure the accuracy of the information contained herein. NOV, Varco® 2010, NOV LP, will not be held liable for errors in this material, or for consequences arising from misuse of this material.

CONVENTIONS; NOTES, CAUTIONS, AND WARNINGS

Notes, cautions, and warnings provide readers with additional information, and to advise the reader to take specific action to protect personnel from potential injury or lethal conditions. They may also inform the reader of actions necessary to prevent equipment damage. Please pay close attention to these advisories.

 **WARNING:** A warning indicates a definite risk of equipment damage or danger to personnel. Failure to observe and follow proper procedures could result in serious or fatal injury to personnel, significant property loss, or significant equipment damage.

 **CAUTION:** A caution indicates that potential damage to equipment or injury to personnel exists. Follow instructions explicitly. Extreme care should be taken when performing operations or procedures preceded by this caution.

NOTE: A note indicates that additional information is provided about the current topics.

ILLUSTRATIONS

Illustrations (figures) provide a graphical representation of equipment components or screen snapshots for use in identifying parts or establishing nomenclature, and may or may not be drawn to scale.

SAFETY REQUIREMENTS

NOV equipment is installed and operated in a controlled drilling rig environment involving hazardous situations. Proper maintenance is important for safe and reliable operation. Procedures outlined in NOV User's Manuals are the recommended methods of performing operations and maintenance.

 **WARNING:** To avoid injury to personnel or equipment damage, carefully observe requirements outlined in this section.

GENERAL SYSTEM SAFETY PRACTICES

 **WARNING:** Read and follow the guidelines below before installing equipment or performing maintenance to avoid endangering exposed persons or damaging equipment.

- Isolate energy sources prior to beginning work.
- Avoid performing maintenance or repairs while the equipment is in operation.
- Wear proper protective equipment during equipment installation, maintenance, or repair.
- Never weld on any parts of tools. The tools are produced from cast alloy heat treated steel and must not be welded in the field. Improper welding can cause cracks and brittleness in heat affected area's which result in weakening of the part and possible failure.

PERSONNEL TRAINING

All personnel performing installation, operations, repair, or maintenance procedures on the equipment, or those in the vicinity of the equipment, should be trained on rig safety, tool operation, and maintenance to ensure their safety.

 **WARNING:** Personnel should wear protective gear during installation, maintenance, and certain operations. Contact the NOV training department for more information about equipment operation and maintenance training.

RECOMMENDED TOOLS

Service operations may require the use of tools designed specifically for the purpose described. NOV recommends that only those tools specified be used when stated. Ensure that personnel and equipment safety are not jeopardized when following service procedures or using tools not specifically recommended by NOV.

REPLACING COMPONENTS

Verify that all components (such as cables, hoses, etc.) are tagged and labeled during assembly and disassembly of equipment to ensure correct installation. Replace failed or damaged components with NOV certified parts. Failure to do so could result in equipment damage or injury to personnel.

ROUTINE MAINTENANCE

Equipment must be maintained on a routine basis. See this book for maintenance recommendations.

 **WARNING:** Failure to conduct routine maintenance could result in equipment damage or injury to personnel.

PROPER USE OF EQUIPMENT

NOV equipment is designed for specific functions and applications, and should be used only for its intended purpose.

LIFTING

The lifting procedures should carefully be observed and carried out according to this book.

LIMITATIONS

The tools are designed to be used in the gas and oil well drilling environment, and must not be used for any other purpose.

WARNINGS FOR USE

 **WARNING:** Always use 3 segment rotary slips as sets (except the XL slip)

 **WARNING:** When a slip is dressed for a new size, always carry out a papertest.

CONVERSIONS

Metric conversions through-out this handbook conform to the Systeme Internationale (SI) metric equivalents.

Metric to US

inches x 25.4 = millimeters (mm)
feet x .3048 = meters (m)
pounds x .4536 = kilograms (kg)
ounces x .0283 = kilograms (kg)
Ton x .9078 = sTonUS to Metric

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sTon x .9078 = Ton

ABBREVIATIONS

Abbr.	Explanation
AO	Air Operated
CL	Center Latch
Csg	Casing
°C	Degree Celsius or Centigrade
DC	Drill Collars
dia.	Diameter
DP	Drill Pipe
EU	External Upset
Elev.	Elevator
°F	Degree Fahrenheit
ft	foot or feet
ft.lbs	foot pounds (= torque)
gpm	(US) gallon per minute
hex	hexagon or hexagonal
ID	Inside Diameter
in.	inch(es)
IEU	Internal External Upset
IU	Internal Upset
kW	kilowatt
kPa	kilopascal
kg	kilogram(s)
lb	pound(s)
m	meter(s)
mm	millimeter(s)
max.	Maximum
min.	Minimum
Nm	Newton meter (= torque)
no.	number
OD	Outside Diameter

Abbr.	Explanation
oz	ounce(s)
P/N	part number
psi	pounds per square inch
qty.	quantity
rpm	rotation per minute
sTon	short tons (US)
sq	square
SD	Side Door
Tbg	Tubing
Ton	metric tons
w/	with
w/o	without
wt	weight
w/Zip	with Zip groove
OD	Outside Diameter
oz	ounce(s)
P/N	part number
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KELLYS & KELLY BUSHINGS

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KELLYS AND KELLY BUSHINGS

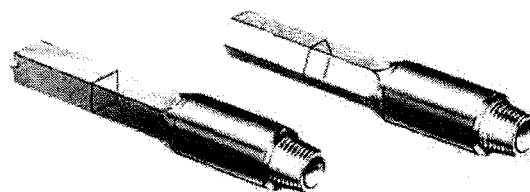
PROPER HANDLING OF KELLYS

The width of the driving surface on the kelly is directly proportional to the amount of clearance between the kelly and the kelly bushing rollers. The tighter the clearance, the wider the driving surface will be.

A few facts about kellys and the causes of wear will give better insight to the importance of kelly bushing maintenance.

Figure 1: Kellys are manufactured either from bars with an as-forged drive section, or from bars with fully machined drive sections. They may be hexagonal or square. When new, both kellys and kelly bushings form perfect hexagons or squares. Figure 1 shows the standard size kellys currently in use. For additional information on kellys of other sizes, refer to API Specification 7.

When the kelly and bushing are new, there is a perfect fit between the two hexagonal surfaces.



*SQUARE	*HEX
2 1/2 In.	3.0 In.
3.0 In.	3 1/2 In.
3 1/2 In.	4 1/4 In.
4 1/4 In.	5 1/4 In.
5 1/4 In.	6.0 In.

Figure 1: Kelly Sizes

Figure 2: When the kelly is put into service, one small mark starts on the roller from kelly contact, the kelly deforms the rollers to provide driving surface on the kelly. The 5 1/4 inch hex kelly is the most popular size kelly in use today.

Due to its strength, small OD tool joint on the pin end and large bore for better hydraulics, it is also one of the hardest kellys to maintain. The kelly measures 5 1/4 inches (133 mm) across the flats and only 6 inches (152 mm) across the corners. The kelly is almost round and must, therefore, be run in a good kelly bushing.

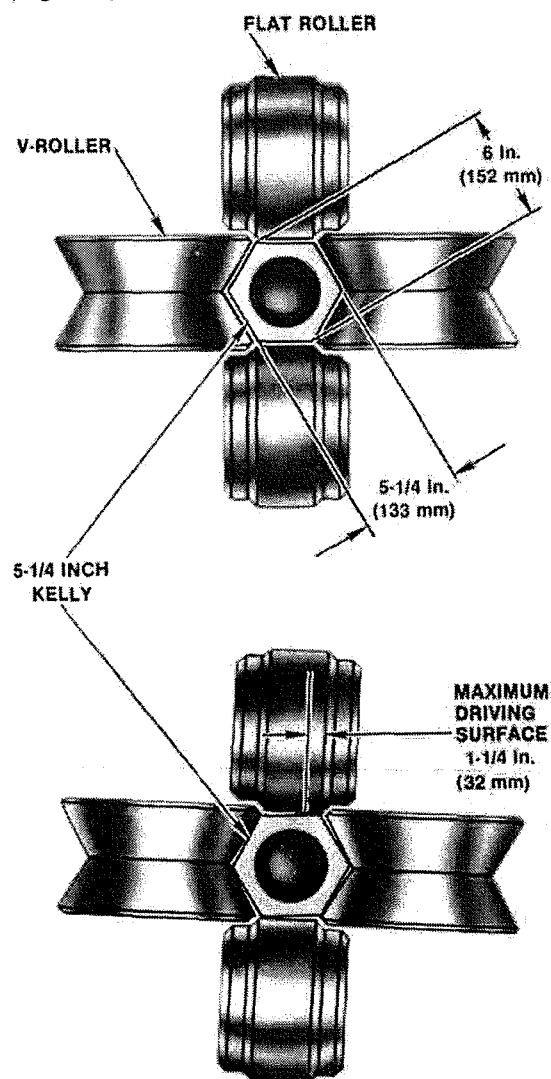


Figure 2: Kelly and Rollers

Figure 3: Shows the API specifications for the two most popular kellys, the 5.1/4 inch hex and the 4.1/4 inch square. Note the tolerances: 5.1/4 + 1/32, -0 inch hex and 4.1/4 + 3/32, -0 inch square.

Figure 4: A good indicator of the condition of the kelly and kelly drive bushing is the width and appearance of the wear pattern on the kelly flats. Recognizing wear patterns can give early warning that the kelly drive bushing requires more than routine maintenance.

Wear pattern width is determined by:

1. Kelly size.
2. Total clearance between kelly and rollers.
3. Roller to kelly contact angle.

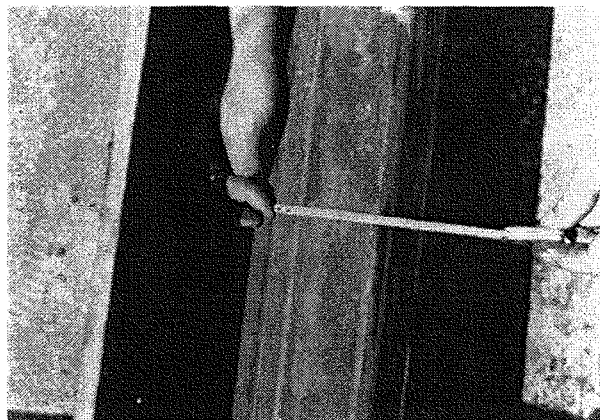


Figure 4: Kelly Inspection

Figure 5: The maximum possible width of wear pattern on a 5.1/4 inch hex kelly is 1.1/4 inches (32mm). Notice that with this amount of drive, the radius on the corner is almost worn off but no metal has started rolling over.

Figure 6: Shows the wear pattern on a new kelly with a kelly bushing in new condition. The driving edge is flat and there is a full 1.1/4 inches (32 mm) of driving edge.

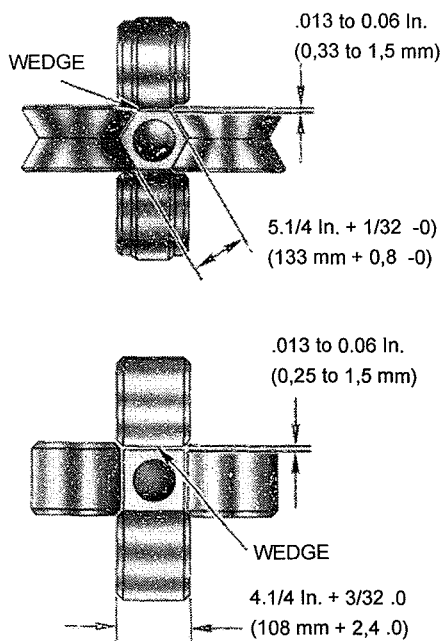


Figure 3: Kelly Tolerances

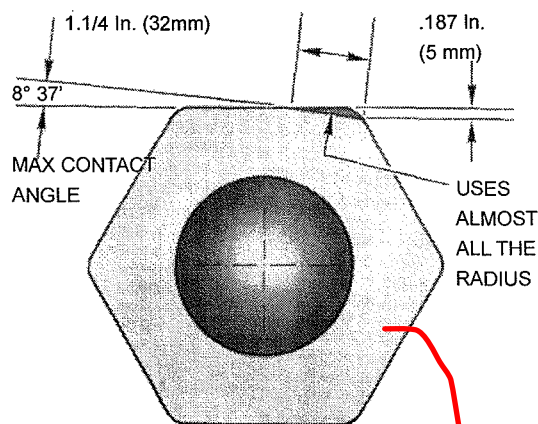


Figure 5 : Maximum Kelly Wear

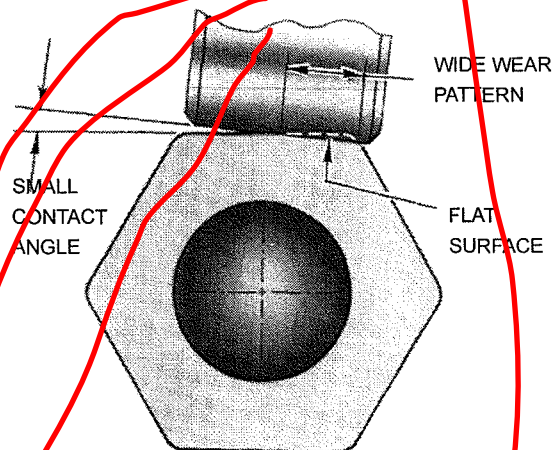


Figure 6: Wear pattern

Figure 7: Shows the condition that exists with a worn kelly and worn parts in the kelly drive bushing. Due to roller wear, the driving edge is no longer flat and the corners have begun to round off.

Figure 8: Shows a kelly with considerable wear in a kelly drive bushing with new roller assemblies. The clearance between the kelly and the rollers has increased, resulting in reduced width of the driving edge and an increased contact angle.

Figure 9: Maximum possible wear pattern widths vary with respect to the size of the kelly. Notice the 5 1/4 inch hex kelly has a 1 1/4 inch (32 mm) drive pattern. These measurements are only obtainable with a new kelly in a new kelly bushing. Narrower drive patterns than those shown are due to additional clearance between kelly and drive rollers.

WHAT CAUSES KELLY WEAR?

Figure 10: This kelly has been deformed by drive forces received from the rollers. The greater the clearance between the rollers and the kelly, the smaller the available drive surface will be.

Figure 11 shows the kelly driving edge being measured. The older driving surface measured 1 1/4 inches (32 mm). Before this kelly was taken out of service, however, the area was reduced to 1/2 inch (12,7 mm) due to excessive clearance between the kelly and the rollers.

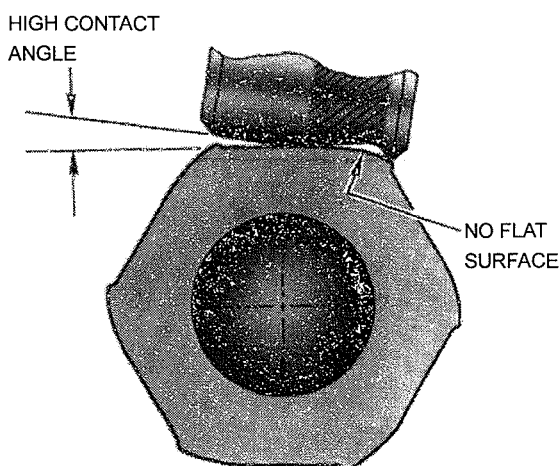


Figure 7: Kelly and Roller Wear Development

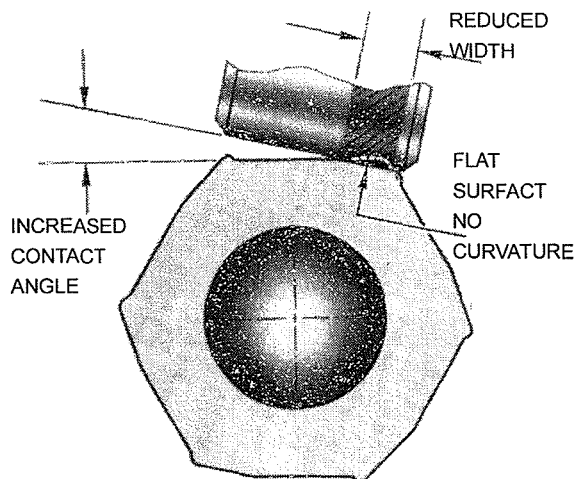


Figure 8: Worn Kelly with New Rollers

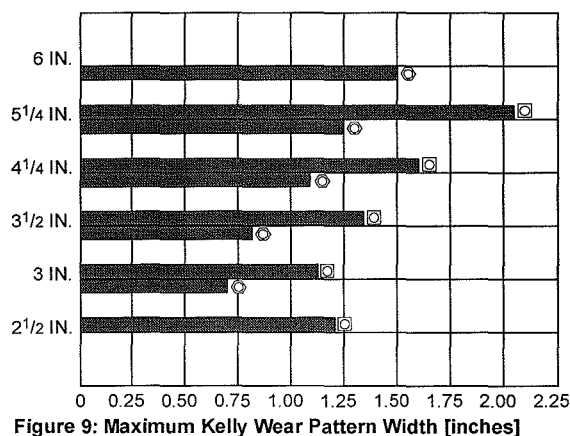


Figure 9: Maximum Kelly Wear Pattern Width [inches]

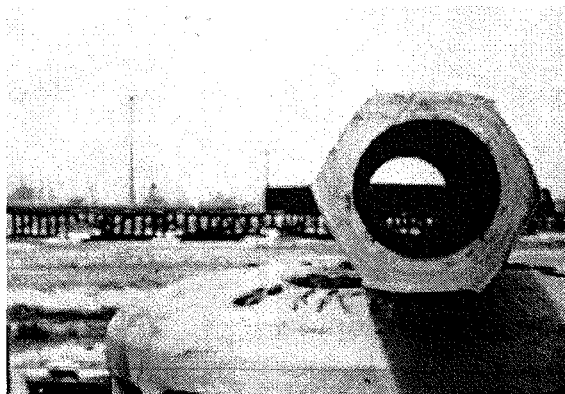


Figure 10: Deformed Kelly



Figure 11: Kelly Measurement

Figure 12: Shows the same kelly with an extreme roll-over of the kelly's driving edge. A watchful eye and the replacement or adjustment of worn parts in the drive bushing would have extended the life of this kelly.

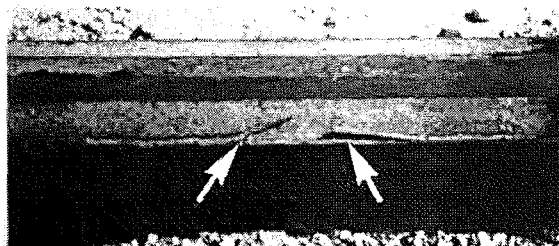


Figure 12 : Driving Edge Wear

Figure 13: Shows a kelly in a drive bushing that was still in use. Observe the area of the kelly just above the drive bushing. The kelly has turned through the rollers of the bushing at this point. A kelly will not turn through the rollers unless too much clearance exists between the rollers and the kelly, reducing the driving surface and increasing the contact angle. If the kelly is put in a high torque situation with this much clearance, the kelly will turn through the bushing again and again.

Therefore, the kelly bushing must be taken out of service and thoroughly inspected for wear.

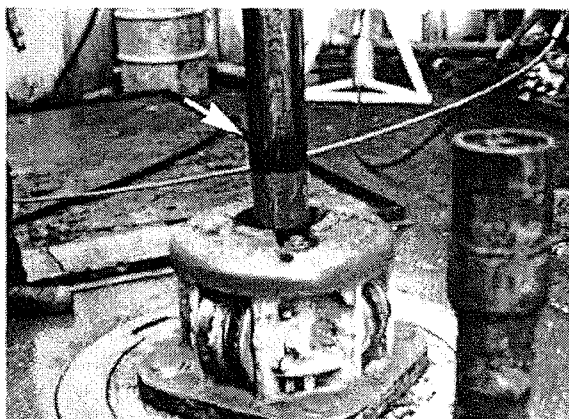


Figure 13: Kelly That Has Turned Through Rollers

Figure 14: Shows a kelly that has been in service for only three months. The driving edge is not 1.1/4 inches (32 mm) but only 1/2 inch (12,7 mm). If the kelly bushing or its parts are not replaced, the kelly will turn through the worn kelly bushing in as little as three more months. The cost of replacing this kelly can be avoided.

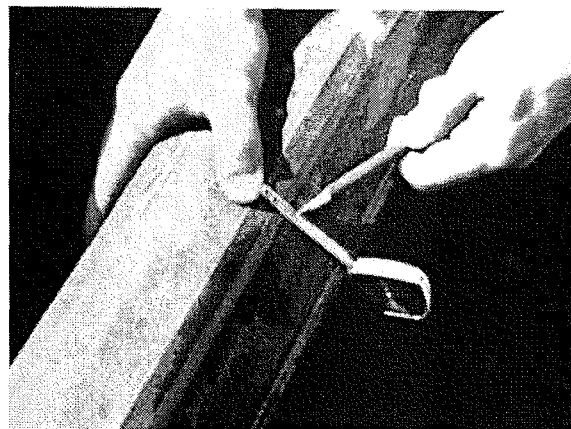


Figure 14 : Driving Edge Inspection

Figure 15: Shows a roller with a driving surface about one inch (25,4 mm) wide, which is pretty good. The wear pattern, however, should be at the bottom on one side of the V and at the top of the other side. This shift in the placement of the driving surface on the rollers is due to wear in assembly parts or in the body of the bushing.

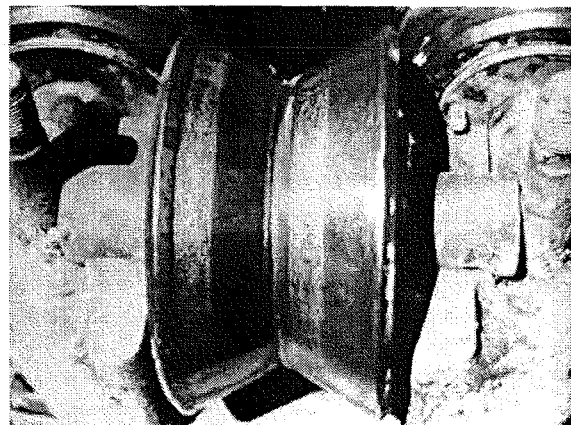


Figure 15: Roller Wear

A kelly may be unusable for three reasons:

1. It is bent.
2. Metal fatigue.
3. The corners of the drive surfaces are worn.

1. Bent kellys

Figure 16: If a kelly has become bent, it should be straightened to avoid high bending stresses and early fatigue damage.

2. Kelly fatigue

Figure 17: Kelly fatigue is likely to occur in three places:

- a. The upper fillet
- b. The lower fillet
- c. In the middle of the kelly body

The fillet is a transition area from the more flexible body of the kelly to the very rigid tool joint section. Even with the 37-degree taper, this transition area is susceptible to fatigue. When the kelly is bored from both ends during manufacture, a misalignment of the two bores may occur at the center due to the boring tools drifting slightly. This creates a possible fatigue point.

3. Worn Kelly Drive Surfaces

If a 5.1/4 inch hex kelly has not turned through the bushing due to wear, it can be milled down 1/8 inch (3,2 mm) on each flat and cleaned up. This kelly would then be referred to as a 5 inch special hex kelly.

If a kelly is remilled it will be necessary to replace the rollers with rollers for the next smaller size kelly.

Before a kelly is sent in to be milled, there are several checks that should be made to see if it will qualify:

1. It should be magnafluxed over its entire length to check for cracks.
2. Check the OD across the corners and across the flats.
3. Check the ID.
4. The wall thickness should be checked by ultrasonic measurement over its entire length.
5. Check the remaining tong area on the tool joints.

Figure 19: The weakest section of a kelly is the lower pin connection. As shown in the chart a 5.1/4 inch hex kelly, bore will have an increased diameter of 3.1/4 to 3.1/2 inches (82 to 89 mm). This weakens the pin section slightly.

Do's:

- Do inspect the kelly frequently.
- Do keep the drive surfaces lubricated and use a kelly wiper rubber.
- Do use a saver sub to prevent wear of the lower pin connection.
- Do use new roller assemblies when a new kelly is put into service.

Don'ts:

- Don't weld on drive corners.
- Don't move or store a kelly without the use of a scabbard.
- Don't use a crooked kelly.

CARE OF KELLYS

Here are some tips on handling kellys to get maximum life from them.

Figure 20: The drive section of a kelly is quite flexible. Due to its length and weight, a kelly should never be handled or moved without being in a scabbard. Always support the scabbard in two places rather than one. The kelly should be tied back to prevent it from being bent.

Figure 22: The weight of the swivel above the kelly will bend it unless tie back precautions are taken. This is especially important on smaller size kellys.

When the kelly is picked up or set back, care should be taken to ease the kelly fillet into the kelly bushing. The shock loads from running the fillet into the rollers of the kelly bushing can damage bearings in the bushing.



Figure 16: Unusable Kelly

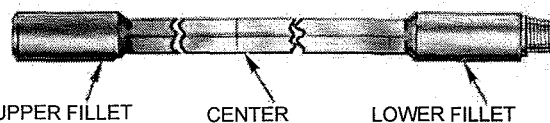


Figure 17: Common Kelly Fatigue Locations

Table size and types [inches]	Kelly bore [inches]	Size and style	Outside diameter [inches]	Tensile yield	
				Lower pin connection [pounds]	Drive section [pounds]
4.1/4 HEX	2.1/4	3.1/2 IF	4.3/4	724,000	1,297,500
*4 HEX	2.5/8	3.1/2 IF	4.3/4	553,800	924,700
5.1/4 HEX	3.1/4	4.1/2 IF	6.1/8	1,162,000	1,707,900
*5 HEX	3.1/2	4.1/2 IF	6.1/8	999,900	1,317,300

Figure 19: Strength of Kellys (New vs. Re-Milled)

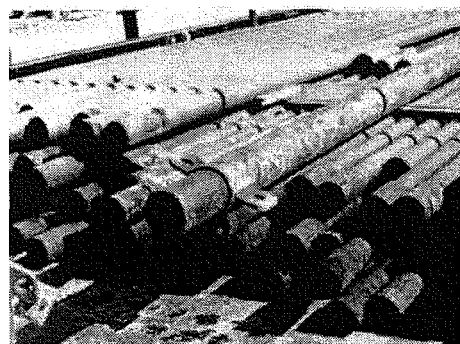


Figure 20: Kelly in Scabbard

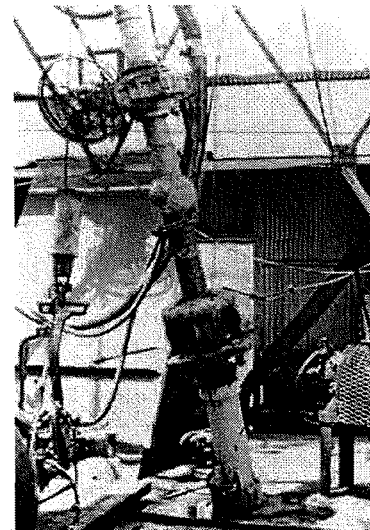


Figure 22: Kelly in Rathole

DESCRIPTION OF KELLY DRIVE BUSHINGS

The kelly drive bushing engages the master bushing in the rotary (either square drive or pin drive). As the rotary turns, the kelly drive bushing turns with it, to drive the kelly. At the same time, as the kelly works down, the rollers in the bushing allow the kelly free movement and keep it centered in the rotary bore.

The earlier square kelly bushings worked fine in the square drive master bushings, but as wells became deeper, longer slips were needed, so the pin drive system was developed. While developing the pin drive kelly bushings, Varco also increased the capability of both the pin drive and square drive, better enabling them to meet the challenges of today's deeper wells. This development became the Heavy Duty, of HD series.

Figure 23: The Varco HDS and HDP (heavy duty square and heavy duty pin drive) kelly bushings have been available since 1967, answering the need for better, stronger kelly bushings for high torque, high speed drilling operations.

Figure 27: The HD series bushing uses bolts pushed up into recesses in the lower body section and locked in place with setscrews. The top nuts are tightened as before but is impossible for the bolt to back out in service.

Figure 28: The HDP bushing uses straight roller pins that lock against each other. Also, the hold-down bolts are outside the load to provide a vise-like grip on the pins.

Figure 29: A significant feature to the thrust washer has been the O-rings on both the OD and the ID that prevent mud and grit from entering the bearing area and also retain grease. Keeping the bearing surfaces clean in this manner results in much longer bearing life. Like the rest of the rotary equipment, the kelly drive bushing has a very long service life (approximately 8 years). Due to this long life, maintenance is often neglected, and premature failure results.

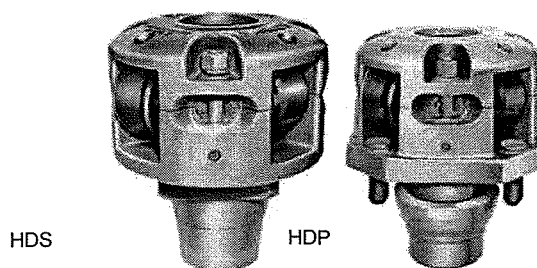


Figure 23: Heavy Duty Kelly Bushings

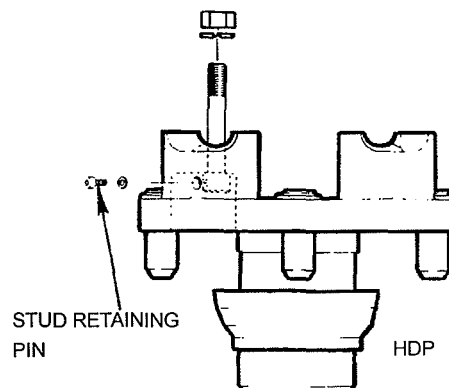


Figure 27: Bolt/Stud Retaining Systems

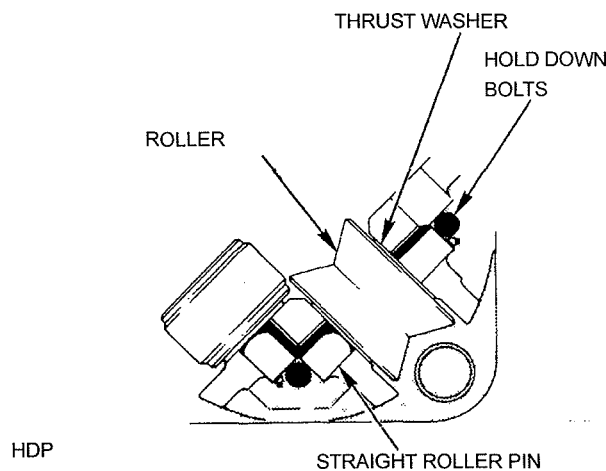


Figure 28: Roller Pin Development (Top View)

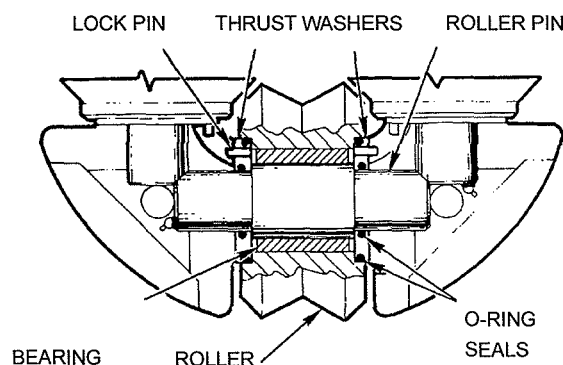


Figure 29: Thrust Washers and Seals

Varco HD Series Kelly Bushings

Figure 30 & 31: The Varco HDP pin drive roller kelly bushing is designed for the most rugged, high torque, high speed drilling conditions in the world. Its roller assembly provides an efficient driving mechanism that maintains good driving edges on the kelly and allows proper feed of the kelly without binding. By changing roller sizes, one bushing can handle several kelly sizes. Other features are a selfcentering stabbing skirt, roller bearings or optional fiber sleeve bearings. The Varco HDP series kelly bushing is widely recognized as the drilling industry standard. The Varco 27 HDP roller kelly bushing is used with Varco pin drive master bushings for 23, 26, 27.1/2, 37.1/2, and 49.1/2 inch rotary tables. The 27 HDP has 3.5/16 inch (84 mm) diameter drive pins on a 25.3/4 inch (654 mm) diameter pin center and will accommodate kelly sizes from 3 to 6 inches hex or square. This heavy duty kelly drive bushing is designed for high torque, high speed conditions.

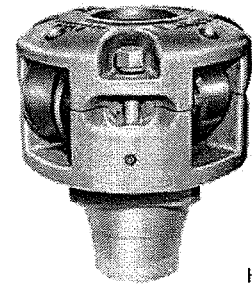
The Varco 20 inch HDP roller kelly bushing is used with Varco pin drive master bushings for 20.1/2, 21, and 22 inch rotary tables. The 20 inch HDP has 2.1/2 inch (63,5 mm) diameter drive pins on a 23 inch (584 mm) diameter pin center. It uses the same rollers, roller assemblies and wiper assemblies as the 27 HDP.

The Varco HDS drive roller kelly bushing (Figure 31) is a heavy duty bushing designed for rugged, high torque applications. The HDS will accommodate square or hex kellys from 3 to 6 inches (76 to 152 mm). The Varco HDS is used with master bushings having an inside drive square dimension of 13.9/16 inches (344 mm). This bushing uses the same rollers, roller assemblies, and wiper assemblies as the 27 HDP.

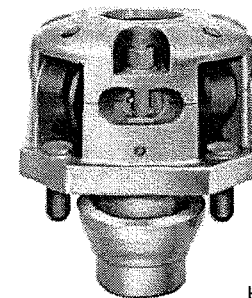
Varco MD Series Kelly Bushings

Figure 32: Varco's MD kelly drive bushing is used for shallow and medium depth drilling operations. Available either as pin drive (MDP) or square drive (MDS), it will accommodate 3, 3.1/2, and 4.1/4 inch hex kellys and 2.1/2, 3.1/2, and 4.1/4 inch square kellys. A direct descendant of Varco's heavy duty (HDP and HDS) kelly drive Bushing, this medium duty drive bushing has the same rugged characteristics built into it. Installation, operation, and maintenance are the same as for the larger bushings.

The MDP can be used on any drilling rig that has the Varco pin drive master bushing in either a 17.1/2 or 20.1/2 inch rotary table. The MDS has an API square to match the API squares in standard square drive master bushings.

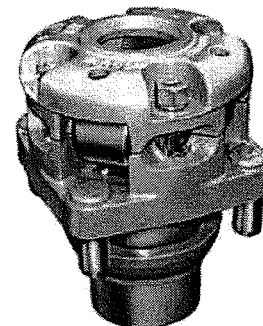


HDS

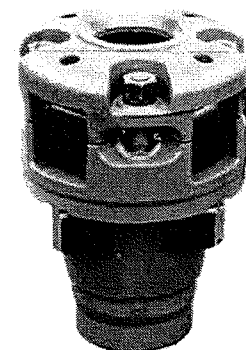


HDP

Figure 30 & 31: HDS & HDP Kelly Bushing



MDP



MDS

Figure 32: MD Series Kelly Bushings

INSTALLATION

Figure 34:

1. Lift and set kelly bushing in master bushing.
2. Remove four nuts and lockwashers.
3. Lift top half of kelly bushing off studs and set aside.
4. Remove the four roller assemblies from lower half of kelly bushing.
5. Set top half of the kelly bushing loosely on bottom half.
6. Stab kelly through bushing.

Note: Make sure that thrust washer lock pins (Figure 35) are toward the center of bushing and lie in the recessed areas of the lower body half.

All kelly bushing thrust washers come with o-rings on the inside and outside diameters. These o-rings help retain grease in the roller bearing while keeping mud and water out.

1. Lift top half of bushing and reinstall roller assemblies.
2. Lower the top half the kelly bushing, aligning it with the locating pin.
3. Install lockwashers and nuts, then tighten alternately until secure.
4. Apply multipurpose, water resistant grease to the roller pin grease fitting before putting the kelly drive bushing into service

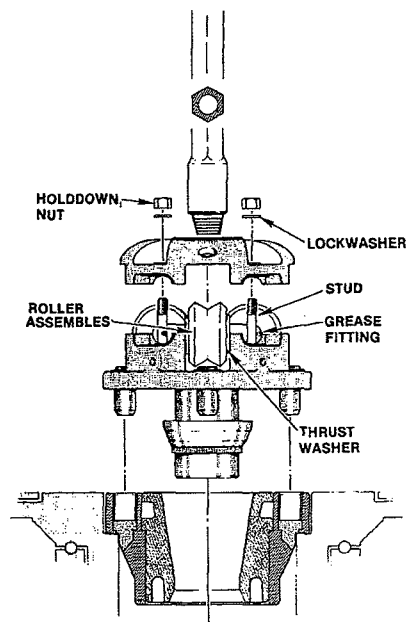


Figure 34: Kelly Bushing Installation

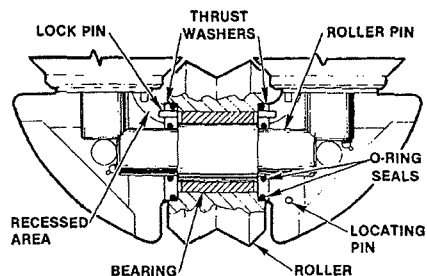


Figure 35: Kelly Bushing Assembly

OPERATION

Figure 36:

1. Lower kelly bushing into the master bushing. The skirt will follow the taper down into the throat of the master bushing. The floating ring (HDP and MDP bushing) will seat in the upper portion of the master bushing, centering the kelly bushing.
2. It is recommended that the rotary table be turned slowly as the kelly bushing is being lowered. The bushing will center and the drive pins (HDP and MDP bushing) will stab into the drive holes of the master bushing.
3. The skirt should be greased to allow the kelly floating ring (HDP and MDP bushing) to move up easily.
4. Care should be taken when lowering the kelly into the rathole. Any sudden, jarring stop when the kelly upset strikes the rollers, can damage the roller assembly.
5. The life of the kelly and drive bushing parts can be increased at least 20 percent by using a kelly wiper rubber. The wiper will keep dirt and other material from getting between the kelly and the rollers, resulting in less wear on all parts.

Note: Applying grease to the kelly will increase the life of the wiper rubbers.

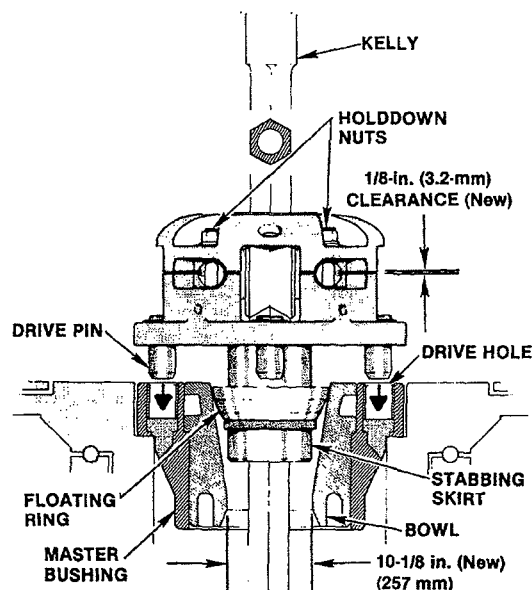


Figure 36: Kelly Bushing in Position

MAINTENANCE & INSPECTION

MAINTENANCE

Figure 36:

1. Tighten holddown nuts weekly.
2. Grease roller assembly daily at four fittings.
3. Grease stabbing skirt for ease of stabbing.*
4. Replace drive pins when bottom taper is too worn to aid in stabbing.
5. Replace the drive hole bushing in master bushing when worn to an egg shape.
6. Replace API drilling bowl when wear in throat area exceeds 10.7/8 inches (276 mm). Proper throat size is necessary for good stabbing.
7. Between the top and bottom body halves there should be 1/8 inch (3,2 mm) clearance; if there is none, worn journals are indicated and the kelly bushing should be replaced.

* HDP and MDP bushings.

INSPECTION

Figure 37 & 38 and further:

Weekly inspection of the kelly bushing is performed as follows:

1. Check to see if top nuts are tight.
2. Use a pry bar to check for body wear and roller assembly wear.
3. Check clearance between rollers and kelly.
4. Check rollers and assemblies for wear.
5. Check the body for wear.

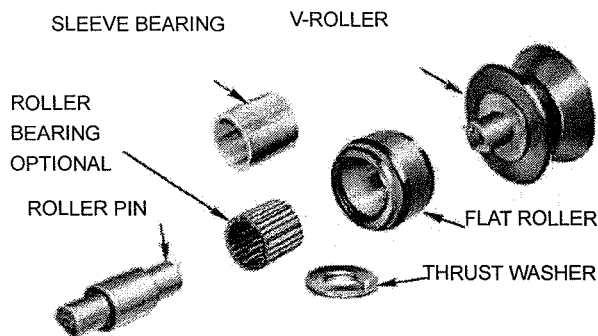


Figure 37: Typical Kelly Bushing Roller Assembly

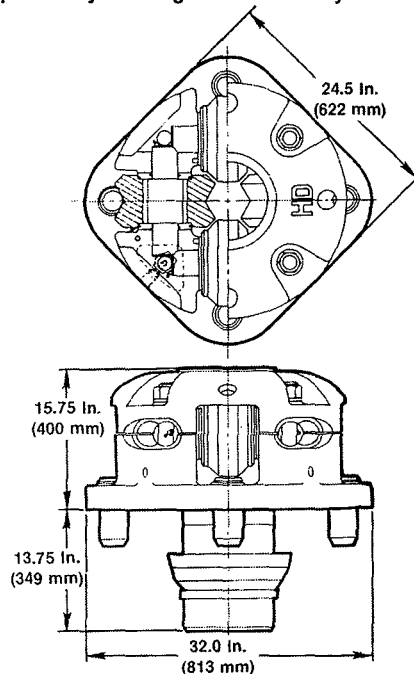


Figure 38: Typical Pin Drive Kelly Bushing

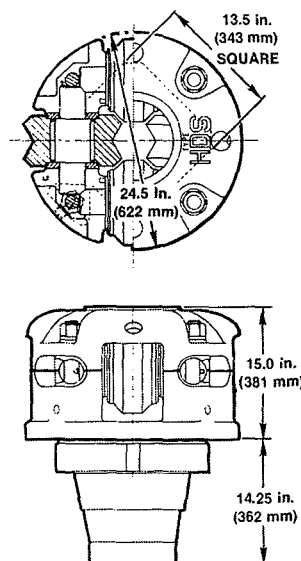


Figure 39: Typical Square Drive Kelly Bushing

Figure 40: The amount of driving surface on the kelly is inversely proportional to the amount of slack present between the roller and the face of the kelly. If, for example, there is only 1/16 inch (1,6 mm) clearance between the roller and the kelly, the driving surface of the kelly will be wide and with the driving forces spread over this wide area, wear will be minimal. However, if this roller-to-kelly dimension were 1/4 inch (6,3 mm), the driving surface would then be considerably reduced and the concentrated force of the rotary would begin to roll the corners of the kelly over.

Figure 41: Shows a 5.1/4 inch hex gauge in a used kelly bushing. The amount of clearance is greater than 1/8 inch (3,2 mm). If the gauge were a kelly and torque was applied, the corners of the kelly would be against the worn spots on the rollers.

During a kelly bushing inspection, the roller assemblies must be checked. The maximum wear suggested by manufacturers is 1/16 inch (1,6 mm) for a hex kelly and 1/8 inch (3,2 mm) on rollers for a square kelly.

Figure 42: Only half the life of the roller assembly has been used. If the roller assembly is turned 180 degrees in the body, however, a completely new drive surface is exposed to the kelly.

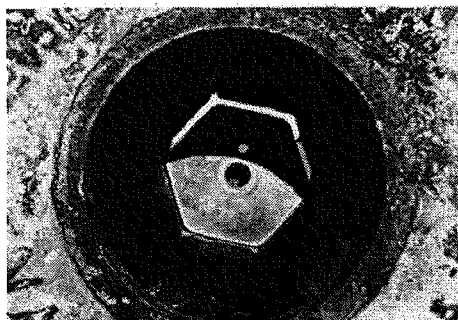


Figure 41: Hex Gauge on Kelly

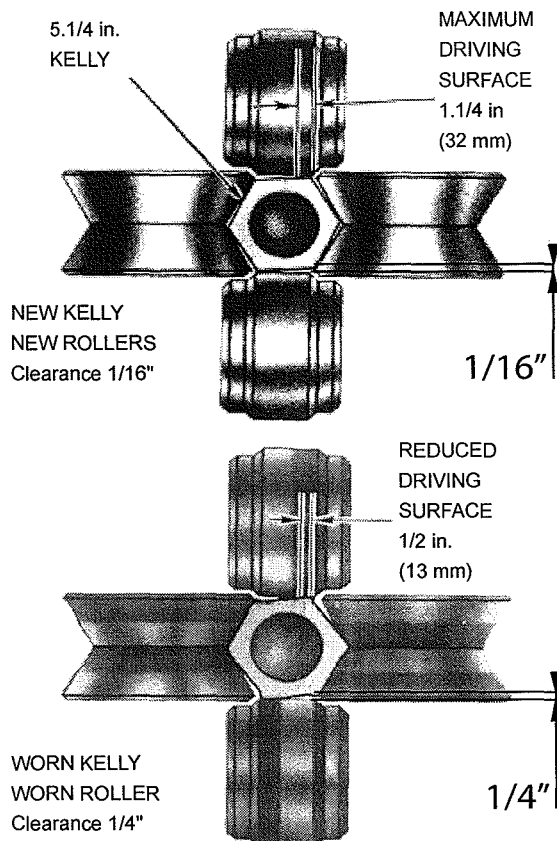


Figure 40: Kelly and Roller Wear

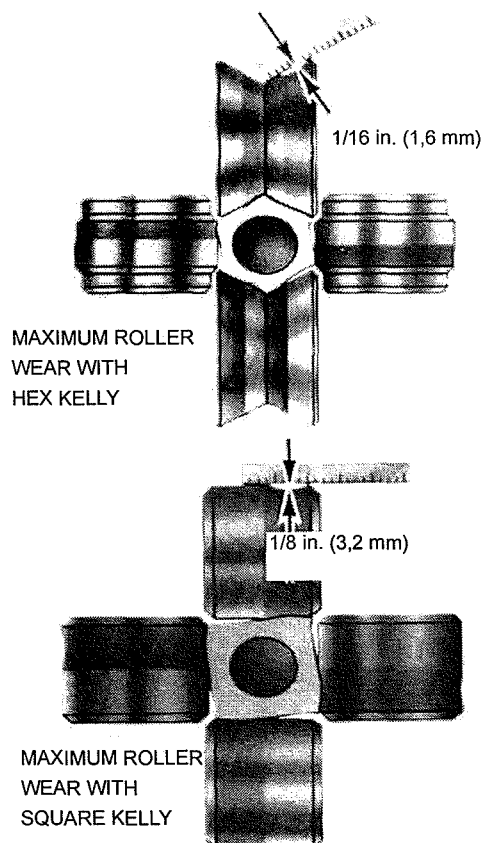


Figure 42: Maximum Roller Wear

Figure 43: Before inspecting a Kelly bushing with a split body for wear, make sure the top nuts are tight.

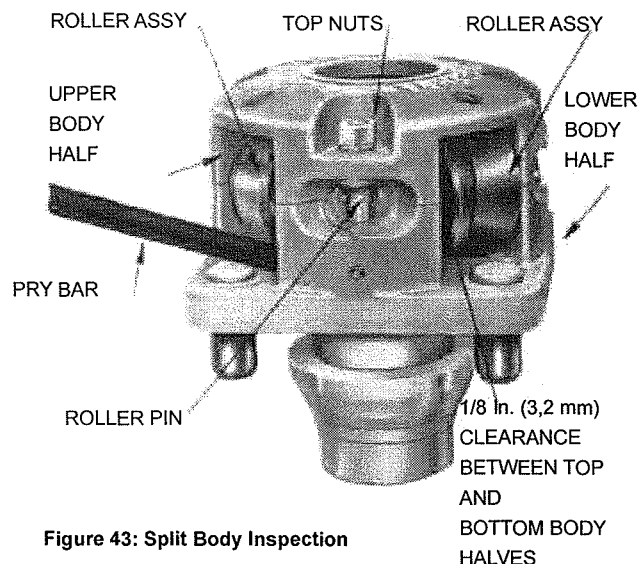


Figure 43: Split Body Inspection

Figure 44: To prevent excessive wear, the nuts should be checked weekly to make sure they are tight.

Varco Kelly bushings have 1/8 inch (3,2 mm) clearance between the top and bottom body halves (in new condition). When the top nuts are tight, this provides a vise-like grip on the roller pins. To check wear in roller assemblies, place a bar under the roller and pry the rollers up. The assembly should not move upward over 1/32 inch (0,79mm).

While checking for roller movement, be sure there is no movement of the roller pin itself by watching the end of the pin. If there is movement of the roller pin, the Kelly bushing body has journal wear. If there is more than 1/32 inch (0,79 mm) movement of rollers, but the pin itself does not move, then the roller bearings should be replaced and the pin inspected for wear.

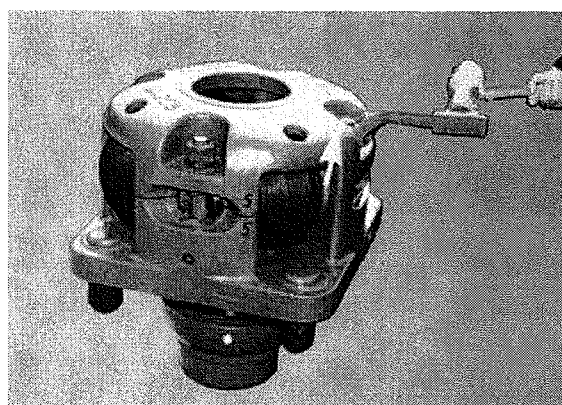


Figure 44: Top Nut Inspection

Figure 45: With the Kelly bushing on the Kelly, the clearance between the drive rollers and the Kelly should be checked. Force a bar between the roller and the Kelly flat surface. The clearance should not be more than 1/8 inch (3,2 mm) clearance. A larger clearance indicates there is wear in the roller assemblies and the bushing body.

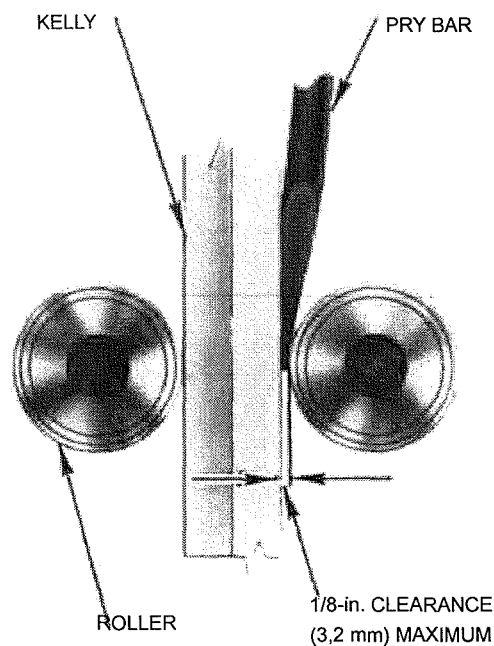


Figure 45: Roller Bearing Inspection

Figure 46: Shows a new roller assembly in position in a new, lower body half. The thrust washer lock pins are retained in the recesses of the lower body half when the top is bolted in place.

Figure 47: Shows the results of very little lubrication and a lock pin is missing on the outside of the right thrust washer. The thrust washer must be locked in the body by the lock pins so that it will not turn on the roller pin. If the pin is missing, the thrust washer will turn, and a deep wear pattern on the roller pin will result. In this case, the thrust washer will no longer absorb the load it was designed to take. This will result in rapid bearing wear, allowing unacceptable clearance between the kelly and kelly bushing rollers.

Figure 48: Check the bearing cage by taking one end in each hand and trying to twist the ends in opposite directions. If there is any movement, the bearing needs to be replaced. If bearings are checked every three months or every rig move and replaced when the bearing cage has movement, before failure occurs, maximum life can be obtained from the kelly and kelly bushing. Here is a new roller pin in an old bushing.

Figure 49: With use of a screwdriver, 1/8 inch (3,2 mm) wear in the journal area is revealed. This wear was caused by not keeping the top nuts tight on a split body bushing, or by an accident where the kelly was either drilled or dropped into the bushing.

Here, the outside dimension of the body journals is being measured. The pencil points out where the new measurement is and shows that there is approximately 1/16 inch (1,6 mm) wear indicated. The exact original measurement is 16.15/16 inches (430 mm).

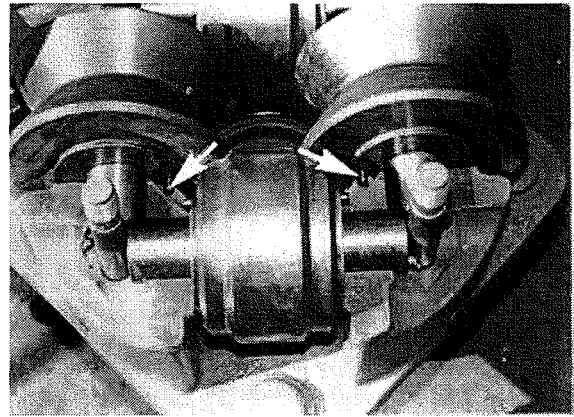


Figure 46: New Roller Assembly

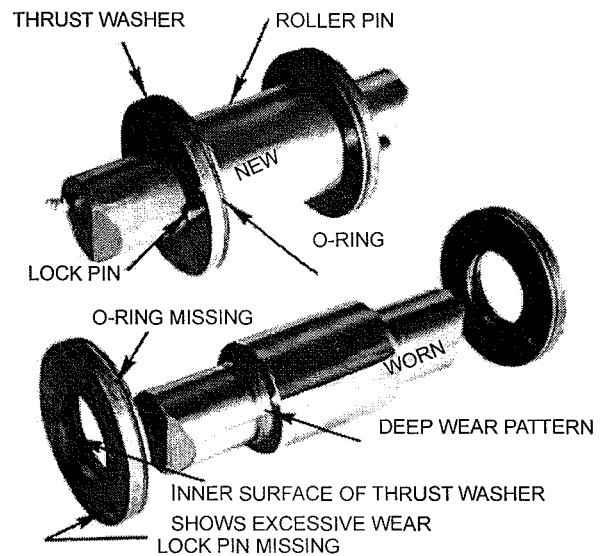


Figure 47: Roller Pin Wear

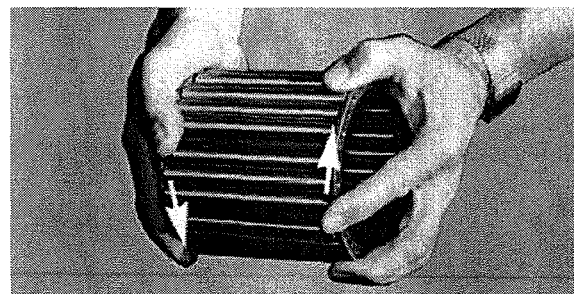


Figure 48: Bearing Cage Inspection

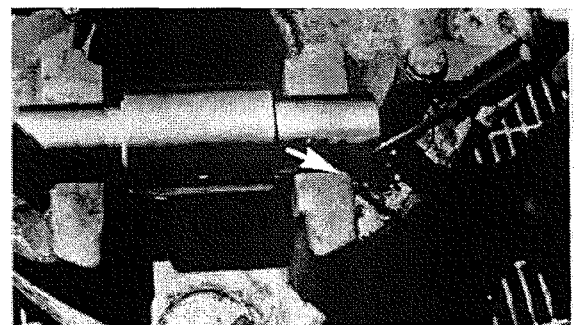


Figure 49: Journal Inspection

Figure 50: Shows maximum allowable wear dimensions across outside journal areas. This type of inspection can be done to determine body wear or spread in the body. Spread in the body of the kelly bushing itself can occur if the total weight of the upper fillet of the kelly is in the rollers of the kelly bushing. This situation can occur if there is a break in one of the tool joints above the body of the kelly. If this does happen, the kelly bushing body and assemblies must be inspected for damage as soon as possible.

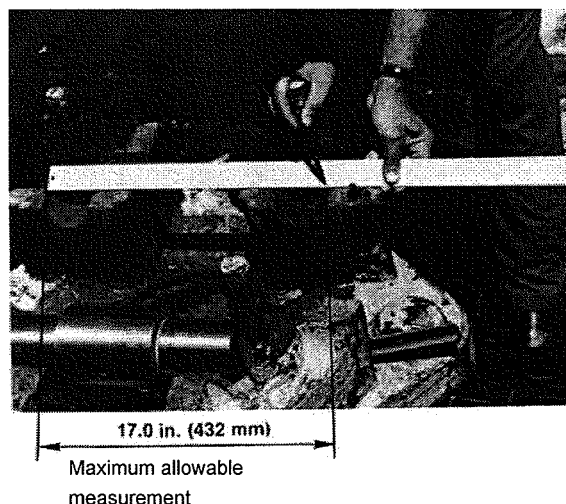


Figure 50: Outside Journal Measurement

INDEXING A KELLY

Figure 51: Shows the difference in the condition of the corners of the kelly. The corners that are against the flat rollers are rolled over more than the corners that are in the V of the other two rollers.

What has happened is that the driving action of the bushing has forced the corner against both sides of the V-roller. This action has pressed the metal in the V-shape.

Indexing the kelly will extend the life of the kelly by 30 to 40 percent if it is indexed after every rig move when the kelly is broken down, or once every three months, whichever comes first.

To index the kelly, remove the top nuts on the bushing, lift the top and remove the roller assemblies. Turn the kelly in the bushing 1/6 of a turn so that the two corners which were against the flat rollers are now in the V of the other rollers. Longer roller assembly life can be achieved by turning the roller assemblies 180 degrees in the bushing body, each time the kelly is indexed. Lower the top and tighten the nuts alternately until it is secure, using a hammer wrench.

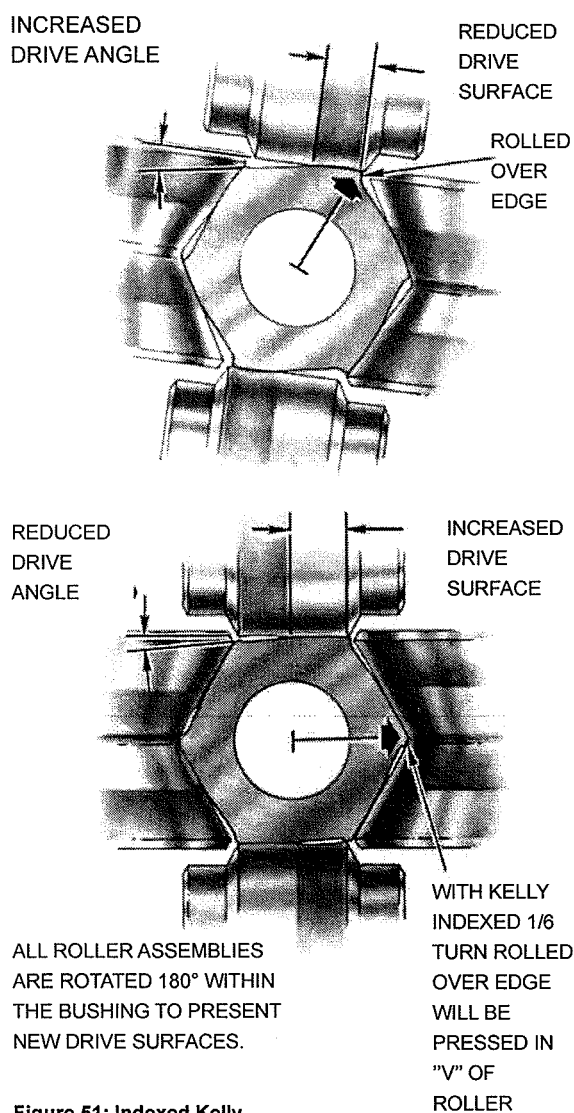


Figure 51: Indexed Kelly

DRIVE PIN REPAIR

Figure 52: After several years of service, the lower taper of the drive pins on the kelly bushing will be worn down to the top of the taper. The following steps should be followed to replace the drive pins:

1. Freeze new drive pins.
2. Remove weld on top of the washer next to the top of the drive pin in the bushing.
3. Use a chisel to drive the washer up from the flange of the kelly bushing.
4. Drive the pin down and out with a sledge hammer.
5. After old pins are removed, clean the rust and burrs from the inside of the taper in the bushing, , and then place them in the freezer.
6. Turn the kelly bushing upside down and preheat the area around the hole 400-450° F (205-235° C).
7. Take the pins one at a time from the freezer and drive them into the bushing until they seat completely.
8. Turn the kelly bushing over and place the drive pin washer over the extended end of the pin and weld it in place. Fill the recessed area of the washer around the drive pin with weld.

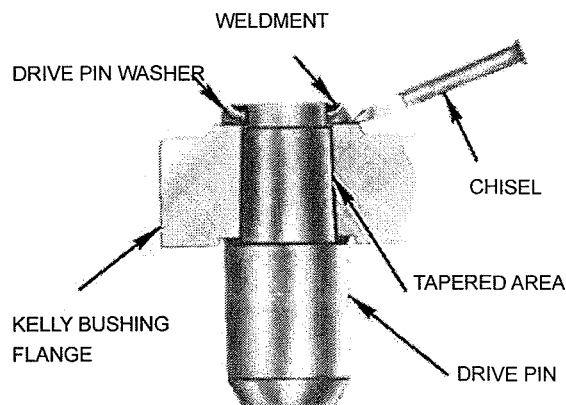


Figure 52: Drive Pin Removal

KELLY BUSHINGS WITH DRIVE PIN LOCKS

Figure 53: When using a motion compensator on a floating operation, the kelly bushing must be locked to the master bushing to prevent the kelly bushing from being pulled out of the drive holes in adverse conditions. Kelly bushings ordered specifically for these conditions, have two drive pins equipped with special locks. These locks must be manually operated to lock the drive pins into the master bushing drive holes.

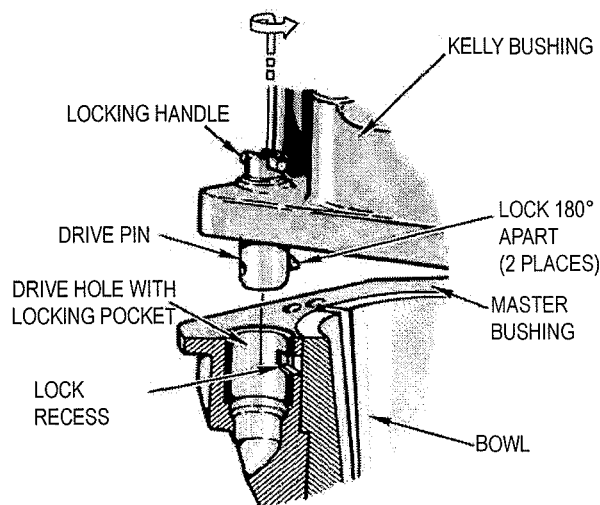


Figure 53: Drive Pin with Lock

KELLYS AND KELLY BUSHING PARTS

Table TD-1 and TD-2: Kellys are manufactured with one of two basic configurations - square or hexagonal. The size of a kelly is measured by the distance across the drive flats.

API standard kellys are manufactured in two lengths: (1) 40 feet (12.2 meters) overall with a 37 foot (12 meters) working space or (2) 54 feet (16.5 meters) overall with a 51 foot (15.5 meters) working space.

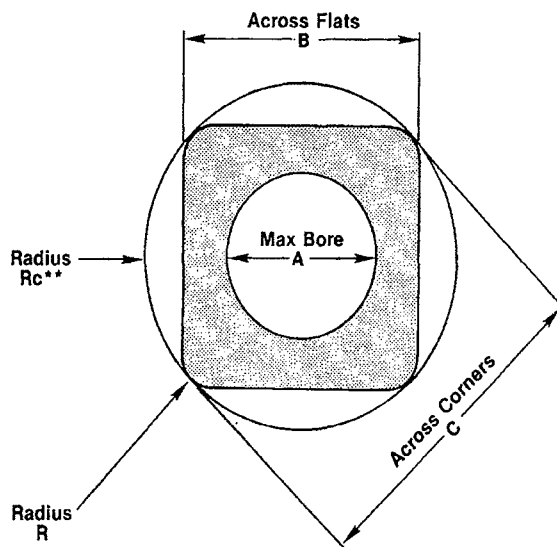


Figure TD-1: Square Kelly

Table TD-1: Measurements of new square kellys

API Std. Sizes	Max Bore A		Across flats B		Across Corners C		Radius R		Radius Rc**	
	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
2.1/2	1.1/4	31.7	2.1/2	63.5	3.9/32	83.3	5/16	8	1.5/8	41.3
3	1.3/4	44.5	3	76.2	3.15/16	100	3/8	9.5	1.15/16	49.2
3.1/2	2.1/4	57.1	3.1/2	88.9	4.17/32	115.1	1/2	12.7	2.7/32	56.3
4.1/4	2.3/4	69.9	4.1/4	107.9	5.9/16	141.3	1/2	12.7	2.3/4	69.9
5.1/4	3.1/2	88.9	5.1/4	133	6.29/32	175.4	5/8	15.9	3.3/8	85.7
*6	3.1/2	88.9	6	152	7.7/8	200	3/4	19.1	-	-

* 6 inch square not API

** Corner configuration manufacturer's option

Table TD-2: Square kelly end connections

API Std. Sizes	Top Connection Reg				Top Outside Diameter				Bottom Connection Standard (RH)	Bottom OD Standard	
	Standard (LH)		Optional (LH)		Standard		Optional				
	inch	mm	inch	mm	inch	mm	inch	mm			
2.1/2	6.5/8	168.3	4.1/2	114.3	7.3/4	196.9	5.3/4	146.1	NC26	3.3/8	85.7
3	6.5/8	168.3	4.1/2	114.3	7.3/4	196.9	5.3/4	146.1	NC31	4.1/8	104.8
3.1/2	6.5/8	168.3	4.1/2	114.3	7.3/4	196.9	5.3/4	146.1	NC38	4.3/4	120.7
4.1/4	6.5/8	168.3	4.1/2	114.3	7.3/4	196.9	5.3/4	146.1	NC46 . NC50	6, 6.1/8	152 , 155.6
5.1/4	6.5/8	168.3	4.1/2	114.3	7.3/4	196.9	5.3/4	146.1	5.1/2 FH , NC56	7	177.8
*6	6.5/8	168.3	-	-	7.3/4	196.9	-	19.1	6.5/8 FH	8	203.2

* 6 inch square not API

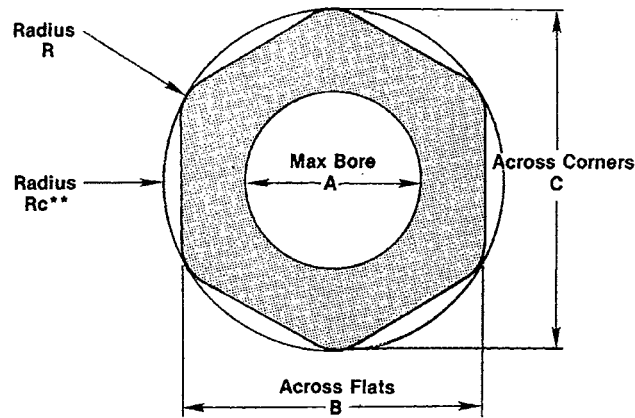


Figure TD-2: Hex Kelly

Table TD-3: Measurements of new hex kellys

API size	Alternative	Max Bore A		Across flats B		Across Corners C		Radius R		Radius Rc**	
		inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
3		1.1/2	38.1	3	76.2	3.3/8	85.7	1/4	6.3	1.11/16	42.9
3.1/2		1.3/4	44.5	3.1/2	88.9	3.31/32	100.8	1/4	6.3	1.31/32	50
	3.1/2	2.1/4	57.1	3.3/4	95.6	4.1/4	107.9	5/16	8	-	-
4.1/4		2.1/4	57.1	4.1/4	107.9	4.13/16	122.2	5/16	8	2.25/64	60.7
	4.1/4	3.1/4	82.5	4.27/32	123	5.1/2	139.7	5/16	8	-	-
5.1/4		3.1/4	82.5	5.1/4	133	5.31/32	151.3	3/8	9.5	2.61/64	75
	5.9/16	4	101.6	5.31/32	151.3	6.3/8	171.5	3/8	9.5	-	-
6		4	101.6	6	152	6.13/16	173	3/8	9.5	3.13/32	86.5
	6.5/8	4.1/4	107.9	6.27/32	173.8	7.3/4	196.9	1/2	12.7	-	-

** Corner configuration manufacturer's option

Table TD-4: Hex kelly end connections

API Std. Sizes	Top Connection Reg				Top Outside Diameter				Bottom Connection Standard (RH)	Bottom OD Standard	
	Standard (LH)		Optional (LH)		Standard		Optional				
	inch	mm	inch	mm	inch	mm	inch	mm			
3	6.5/8	168.3	4.1/2	114.3	7.3/4	196.9	5.3/4	146.1	NC26	3.3/8	85.7
3.1/2	6.5/8	168.3	4.1/2	114.3	7.3/4	196.9	5.3/4	146.1	NC31	4.1/8	104.8
4.1/4	6.5/8	168.3	4.1/2	114.3	7.3/4	196.9	5.3/4	146.1	NC38, NC46	4.3/4 , 6	120.7, 152
5.1/4	6.5/8	168.3	-	-	7.3/4	196.9	-	-	NC50, 5.1/2 FH	6.1/8	155.6
6	6.5/8	168.3	-	-	7.3/4	196.9	-	-	NC56	7	177.8

ROLLER KELLY BUSHINGS

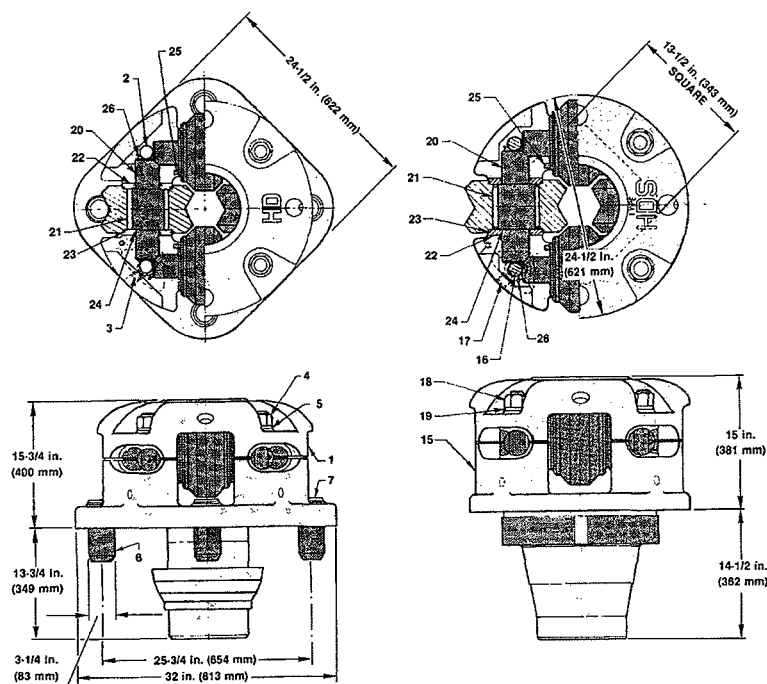


Figure TD-5: HDS Heavy duty square drive roller kelly bushing.

Used for heavy duty drilling in 17 1/2 to 27 1/2 inch rotary tables with square drive master bushings. Fits any standard 17 1/2 to 27 1/2 inch split master bushing.

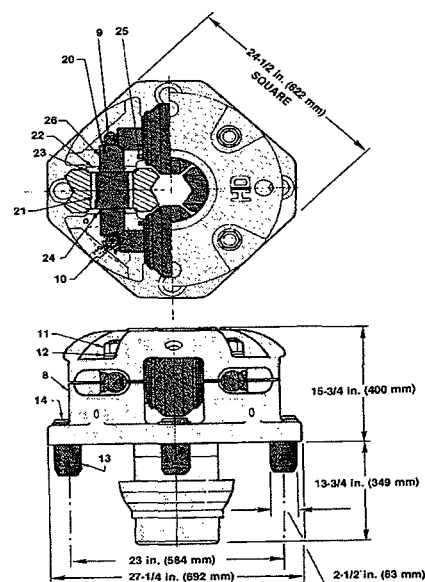
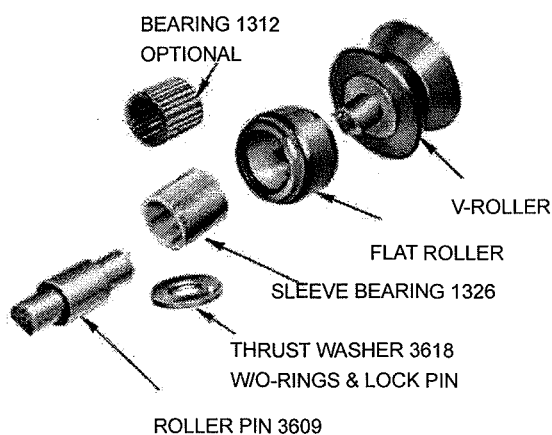


Figure TD-3: 20-HDP Heavy duty pin drive roller kelly bushing.

Roller Parts

HDP & HDS



Kelly Bushing Assemblies w/ rollers

Kelly Size Size/Type	27" HDP Part No.	20" HDP Part No.	27" XHDP Part No.	HDS Part No.
3" Hex	3650-30	-	-	-
3 1/2" Hex	3650-35	3690-35	-	3635-35
4 1/4" Hex	3650-42	3690-42	70947-1	3635-42
5" Spec. Hex	3650-50	-	-	-
5 1/4" Hex	3650-52	3690-52	-	3635-52
6" Hex	3650-60	-	70947-2	3635-60
2 1/2" Sq	-	-	-	-
3" Sq	3651-30	-	-	3636-30
3 1/2" Sq	3651-35	3691-35	-	3636-35
4 1/4" Sq	3651-42	3691-42	-	3636-42
5 1/4" Sq	3651-52	3691-52	70947-3	3636-52
6" Sq	3651-60	-	70947-4	-

Figure TD-6: Roller Assemblies and Parts for HDP & HDS Kelly Bushings

KELLY BUSHING PARTS

Table TD-5: Parts List for Varco Type 20 HDP, and 27 HDP, HDS, Roller Kelly Bushings

				Weight	
				Lbs	kg
20 HDP Bushing complete and body parts					
-	Roller Kelly Bushing Complete for Square Kelly with Wrench, Less Wiper Assembly, Less Rollers	1	3691	1470	666,8
-	Roller Kelly Bushing Complete for Hex Kelly with Wrench, Less Wiper Assembly, Less Rollers	1	3690	1435	650,9
8	Body Assembly Complete, less Roller Assembly	1	3692	958	434,5
9	Holddown Bolt less Lockscrew	4	13501	7	3,2
10	Holddown Bolt Lockscrew with Washer	4	3657	1/4	0,11
11	Holddown Bolt Nut	4	1208	1.7	0,8
12	Lockwasher	4	50924	1/3	0,15
13	Drive Pin	4	1505	9	4
14	Drive Pin Washer	4	1506	1	0,45
-	Wrench	1	1210	8	3,6
27 HDP Bushing complete and body parts				Lbs	kg
-	Roller Kelly Bushing Complete for Square Kelly with Wrench, less Wiper Assembly, Less Rollers	1	3651	1500	680,4
-	Roller Kelly Bushing Complete for Hex Kelly with Wrench, less Wiper Assembly, Less Rollers	1	3650	1468	665,9
1	Body Assembly Complete, Less Roller Assembly	3653	990	49,1	
2	Hold own Bolt Less	4	13501	7	3,2
3	Holddown Bolt Lockscrew with Washer	4	3657	1/4	0,11
4	Holddown Bolt Nut	4	1208	1.7	0,8
5	lockwasher	4	50924	1/3	0,15
6	Drive Pin	4	1605	10	4,5
7	Drive Pin Washer	4	1506	1	0,45
-	Wrench	1	1210	8	3,6
HDS Bushing complete and body parts				Lbs	kg
-	Roller Kelly Bushing Complete for Square Kelly with Wrench, less Wiper Assembly, Less Rollers	1	3636	1420	644,1
-	Roller Kelly Bushing Complete for Hex Kelly With Wrench, less Wiper Assembly, Less Rollers	1	3635	1384	627,8
15	Body Assembly Complete less Roller Assembly	1	3637	900	408,2
16	Holddown Bolt less Lockscrew	4	13501	7	3,2
17	Holddown Bolt Lockscrew with Washer	4	3657	1/4	0,11
18	Holddown Bolt Nut	4	1208	1.7	0,8
19	Lockwasher	4	50924	1/3	0,15
-	Wrench	1	1210	8	3,6
HDS 20 HDP AND 27 HDP Roller assembly parts, less rollers				Lbs	kg
20	Roller Pin	4	3609	31.5	14,3
21	Sleeve Bearing	4	1326	2	0,9
-	Roller Bearing (Optional)	4	1312	7	3,2
22	Thrust Washer, Less O-Rings	8	3610	4.9	2,2
-	Thrust Washer with 2 O-Rings	8	3618	5	2,3
23	O-Ring OD	8	53100-255B	1.5 oz	42 g
24	O-Ring ID	8	53100-233B	1.5 oz	42 g
25	Thrust Washer Lock Pin	8	2 oz	56g	
26	Lube Fitting	4	53202	1 oz	28 g
27	Template	1	3615	8 oz	224 g

Table TD-5: Varco Type HDS and HDP Roller Kelly Wiper Assemblies

Description	For square kellys			For hex kellys		
	Part No.	Weight		Part No.	Weight	
Kelly wiper assemblies [inches]		Lbs	kg		Lbs	kg
3"	1320-S30	12.25	5.5	1320-H30	12.25	5.5
3.1/2"	1320-S35	12.25	5.5	1320-H35	12.25	5.5
4.1/4"	1320-S42	12.25	5.5	1320-H42	12.25	5.5
5" special	-	-	-	1320-H50	12.25	5.5
5.1/4"	320-S52	12.25	5.5	1320-H52	12.25	5.5
6"	1320-S60	12.25	5.5	1320-H60	12.25	5.5
Kelly wipers	Part No.	Weight		Part No.	Weight	
		Lbs	kg		Lbs	kg
3" Wiper	12100	4	1.8	12107	3.9	1.8
3.1/2" Wiper	12101	3.7	1.7	12108	3.8	1.7
4.1/4" Wiper	12102	3.6	1.6	12109	3.6	1.6
5" Wiper	-	-	-	12110	3.1	1.4
5.1/4" Wiper	12103	3.2	1.4	12111	3.2	1.4
6" Wiper	12104	3	1.3	12112	3	1.3
Retaining plate	1321	3.5	1.6	1321	3.5	1.6

Table TD-6: HDP & HDS Roller Assemblies

Kelly Size/Type [inches]	Part No.	Weight	
		Lbs	kg
3 Sq	3660	590	267.6
3.1/2 Sq	3661	562	254.9
4.1/4 Sq	3662	512	232.2
5.1/4 Sq	3665	438	198.9
6 Sq	3666	374	169.6
3 Hex	3667	612	277.6
3.1/2 Hex	3668	584	264.9
4.1/4 Hex	3669	532	241
3 5 Sp. Hex	3671	486	220.4
5.1/4 Hex	3672	476	215.9
6 Hex	3673	414	187.8

Note: *NOV will provide sleeve bearings as a standard, unless a preference for roller bearings is specified.

Table TD-7: HDP & HDS Rollers Only (4 Per Set)

Kelly Size/Type [inches]	Part No.	Weight	
		Lbs	kg
3 Sq	1331-4	396	179.6
3.1/2 Sq	1332-4	368	166.9
4.1/4 Sq	1333-4	318	144.2
5.1/4 Sq	1334-4	244	110.7
6 Sq	1335-4	180	81.6
3 Hex	1338-39	418	189.6
3.1/2 Hex	1340-41	390	176.9
4.1/4 Hex	1342-43	338	148.3
5 Hex	1387-88	292	32.5
5.1/4 Hex	1344-45	292	32.5
6 Hex	1346-47	220	99.8

MASTER BUSHINGS



MASTER BUSHINGS



MASTER BUSHINGS

Proper handling of master bushings and slips

Figure 54: One of the most expensive pieces of equipment on the rig is the drill pipe. Not only is it expensive, but it is in very short supply. Typically, worn master bushings and slips are discovered when inserts are wearing out much more rapidly than usual or when a drill pipe inspection reveals crushed or bottle necked pipe. This is a needless waste of valuable material - a regular program of rotary equipment inspection could have spotted the problem in plenty of time to make corrections, without damaging the drill pipe. In simple terms a comparison can be made between slips and a wedge driven into a log. The wedge's taper produces a side load or transverse force which is transmitted into the log. This transverse force is much greater than the axial force applied by the hammer to the wedge. If the wedge is clean and well lubricated, the coefficient of friction between the wedge and the wood is low. Thus, the ratio between the force applied by the hammer and the resulting splitting force on the wood is much greater. If the wedge is dry, dirty, or rusty with insufficient lubrication the coefficient of friction is high. When the coefficient of friction increases, drag increases between the wood and the wedge and it takes a much greater axial force applied by the hammer to split the log.

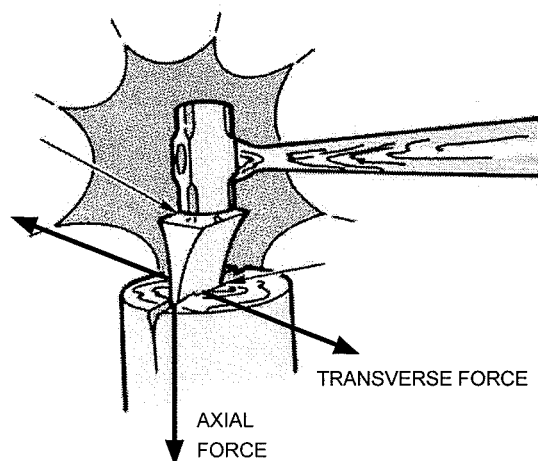


Figure 54: Slips and Master Bushing Forces

A related principle applies with slips and master bushings that are suspending pipe in the rotary. The slip is the wedge. The hook load is the axial force or vertical load. However, when splitting a log, the two halves of the log are not restrained from outside forces as in the case of slips and pipe in a master bushing. The slips' job is not to actually do work - it simply supports a static load. Due to the fact that the master bushing is restraining the outward force, the weakest component becomes the drill pipe.

Figure 55: Shows the coefficient of friction between the rotary slip and the master bushing, depending on the condition of the mating surfaces. The lower the coefficient of friction between the slip and the master bushing taper, the greater the amount of transverse or crushing force per pound of axial or hook load. If, for example, a hook load of 100,000 pounds (45,360 kg) is used, it can be seen from this chart what the resulting transverse load would be. With dirty, dry, or rusty slips and master bushing tapers, the ratio is 1.4 to 1. With new, clean, well lubricated slips and master bushing tapers, the ratio would be 4.4 to 1. The average ratio would be 3 to 1. This means that 100,000 lbs (45,360 kg) results in 300,000 lbs (136,079 kg) of transverse load. This high transverse load is why the master bushing and slips must be kept in good condition (or the pipe may become bottlenecked).

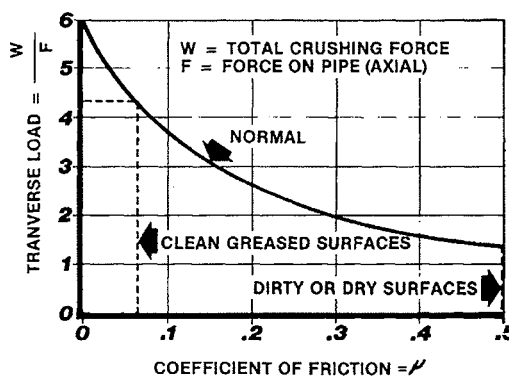


Figure 55: Results of Friction Between Slips and master Bushing

Figure 56: One question is very important: How is this force distributed along the length of the slip inset contact area? The hook load or axial force starts at zero at the top and increases to a maximum at the toe of the slip. The transverse load or crushing force begins with a minimum at the top, increasing to a maximum in the center, then decreasing to a minimum again at the toe.

In practical application on a rig, these two forces act upon each other, resulting in a concentration of force slightly less than halfway above the throat of the master bushing. Heavy strings of drill pipe can be handled without any damage to the pipe in the slip area, if the rotary slip is supported so that the load is distributed equally on all of the inserts. If the slips are not supported correctly, bottlenecking of drill pipe will occur.

If slips and master bushings are kept in good condition, the massive crushing force that exists will be equally distributed. When this force is distributed along the entire length of the slip, pipe is not damaged. Wear in both the ID of the master bushing and on the backs of the slips, however, reduces the length of load distribution to only the area near the top of the slip, resulting in bottlenecking of drill pipe.

Figure 57: The API standard master bushing is 10-1/8 inches (257 mm) in diameter at the throat, tapering at a rate of 4 inches per foot, to a diameter of 13-1/16 inches (332 mm) at the top. The tapered section is 8-13/16 inches (224 mm) in length. Notice that the remaining 4 inches (102 mm) of the master bushing is recessed to accept the square drive of the kelly bushing.

Figure 58: The square drive bushing was approved by the API over 35 years ago when a 10,000 foot (3,048 m) well was considered deep. As hook loads became heavier, drill pipe was being crushed more frequently. Slip manufacturers increased the slip insert area from 12 to 18 inches (305 to 457 mm) and more, without increasing the support area for the slips themselves. This did not solve the problem.

Figure 59: In the late 1950s, Varco realized the need for additional support for the slip bodies. In an effort to gain this needed support, the kelly drive was transferred to the top of the master bushing by the use of pins. The taper was then brought to the top of the master bushing, providing an additional 4 inches (102 mm), or almost 50 percent increase in slip support. This increased the taper length to 12-3/4 inches (324 mm) as opposed to 8-13/16 inches (224 mm) in the standard square drive master bushing.

Both long and extra-long rotary slips have the same amount of insert contact. The major difference between the two slips is the length of the tapered area. This longer bowl backup results in lower overall cost, longer life, and increased protection for the drill pipe.

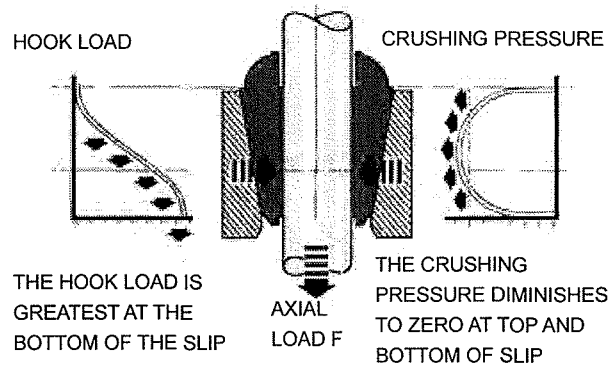


Figure 56: Distribution of Forces

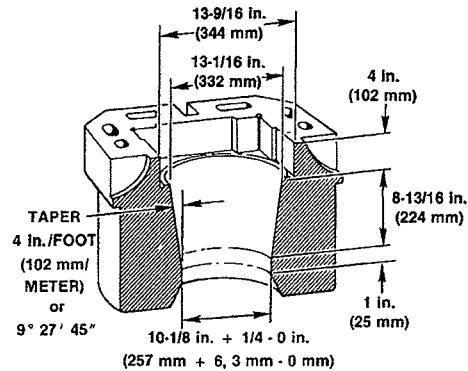


Figure 57: API Standard Split Square Drive Master Bushing Dimensions

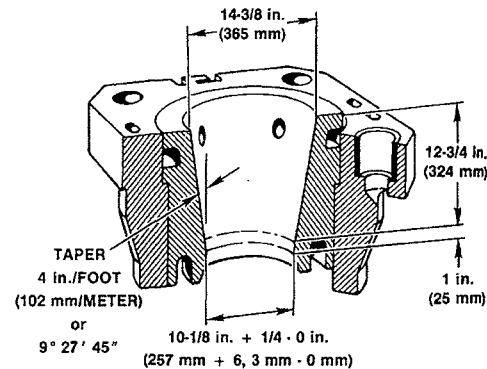


Figure 58: API Standard Slid Pin Drive Master Bushing Dimensions

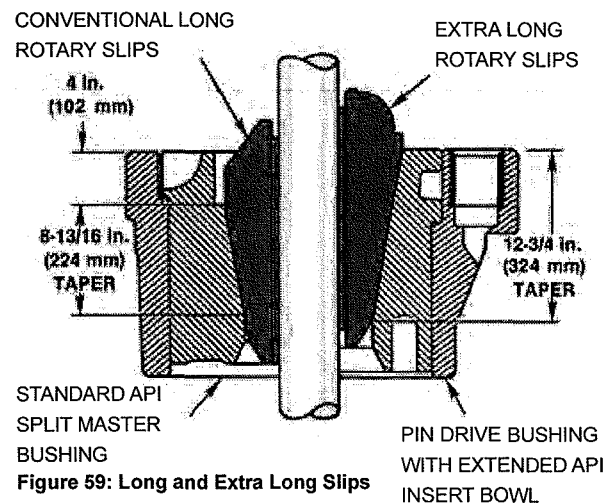


Figure 59: Long and Extra Long Slips

VARCO BJ MASTER BUSHINGS

Varco 20.1/2 thru 27.1/2 Solid Body Pin Drive Master Bushing (MSPC)

Figure 60: The Varco MSPC is designed for all drilling operations. The pin drive allows the kelly bushing to ride on top of the rotary table and permits extended bowls to be used for better slip backup. Better slip backup means heavier strings can be run without the danger of bottlenecking. With the extended API insert bowl No. 3, the MSPC will handle 2.3/8 thru 8-5/8 inch OD drill pipe, drill collars, tubing, and casing. Insert bowl No. 2 can handle tubular goods 9.5/8 and 10.3/4 inches OD; while insert bowl No. 1 is good for 11.3/4 and 13.3/8 inches OD. The MSPC, with proper insert bowls to accommodate a given diameter string, has a maximum capacity of 500 tons. The MSPC has locks that hold the bowls securely in the bushing. The solid outer body takes all transverse loads and provides proper backing for the split insert bowls, allowing the rotary table to rotate freely, unimpaired by transverse stress.

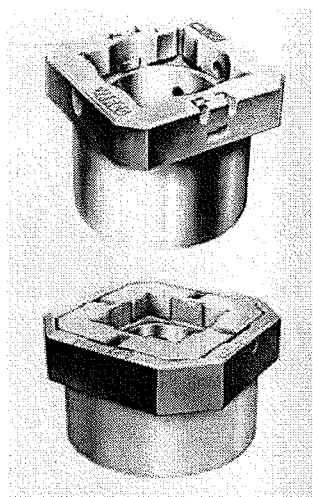
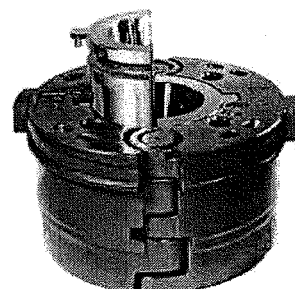


Figure 60: Square Drive Bushings

Varco 37.1/2 and 49.1/2 Hinged Pin Drive Master Bushing (MPCH)

Figure 63: The MPCH is specifically designed for floating and semisubmersible drilling operations. With insert bowl No. 3 and optional insert bowls 1 and 2, the MPCH will handle 2.3/8 to 13.3/8 inch OD drill pipe, drill collars, tubing and casing (with a design capacity of 500 tons). The MPCH has all the performance features of a solid master bushing yet with a hinged design, the MPCH can be removed from the drill string to pass large bit and pipe connections directly through the rotary table.



MPCH

Figure 63: Pin Drive Hinged Master Bushing

The MPCH incorporates locking latches that lock the bowls into the bushing. Bowls are also equipped with retainer pins to prevent them from falling out when the master bushing is hinged open. The MPCH can also be equipped with latches that lock into the rotary table.

Varco casing bushings

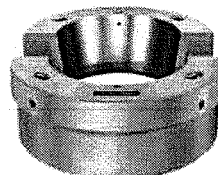
Figure 64: CU, CUL, and CB casing bushings are inserted directly into the rotary table and insure that the casing being run is perfectly aligned with the center of the hole. Models CU and CUL are solid bushings and Model CB is a split bushing. All of these bushings accept bowls of different sizes to accommodate a wide range of casing. Used with Varco's CMS-XL Slips, these bushings can handle the longest casing strings currently being set. Also, since these bushings fit into the rotary table, the casing string can be rotated during cementing operations.



CU



CUL



CB

Figure 64: Casing Bushings

Bit breaker adapter plate

Figure 65: A bit breaker adapter plate is furnished with every Varco pin drive master bushing to convert the round opening of a pin drive master bushing to a 13.9/16 inch standard, API square drive opening. All rock bit companies furnish bit break-out boxes which fit into this opening. The adapter plate is held in place with four pins which fit into the four drive pin holes of the bushing.

When using bits in excess of 12.1/4 inches, such as the 15.1/2 inch bit, it is suggested that a 15.1/2 inch box (394 mm) be welded on top of a standard size box which will, in turn, fit into the Varco bit breaker adapter plate.

Size	Part numbers
27.1/2"	1816
20.1/2	1815

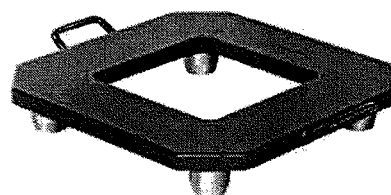


Figure 65: Bit Breaker Adapter Plate

MAINTENANCE AND INSPECTION

Maintenance

Figure 66:

1. When changing insert bowls, check top diameter of bushing bore and inspect bowl seat for burrs and peened-over edges; file or grind flush as required. This procedure will ensure easy installation and proper fit.
2. Clean the inside taper of the drilling bowls of any abrasive material. This will cut down the rapid wear on both slip backs and taper. It will also provide easy handling of slips and keep them from sticking in the bushing.
3. Lubricate the inside taper of the drilling bowls (when tripping) to prevent slips from sticking in the bowls.
4. Lubricate the back of the drilling bowl each time it is removed from the hull. This will prevent the bowls and slips from sticking and reduce master bushing ID wear.
5. Replace lock assembly when it ceases to function.

Figure 89:

6. Replace the API drilling bowls when throat measurement exceeds 10.7/8 inches (276 mm) on extended API bowls.
7. Replace API drilling bowls when a straight edge held against taper indicates wear from the tool joint in the tapered section of the bowls
8. When the backs of the rotary slips and the taper of the bowls become rough, both of these surfaces must be polished by using emery cloth on the backs of the slips or a flexible, fine sandpaper disk. Keeping these surfaces polished will help prevent sticking.
9. Hinge Pins (MPCH Only):
 - The stationary hinge pin (without bail) has one lube fitting located at top center. This pin should be greased daily.
 - The removable hinge pin (with bail) should be cleaned up and greased each time it is taken out. It has a lube fitting located at top center.

Inspection

Figure 66: Inspection is the most important aspect of preventive maintenance. Inspection consists of observing, measuring, and testing. There is wear in the ID of the rotary table which gives insufficient support for the master bushing itself.

1. The OD of the master bushing is worn.
2. There is excessive wear in the taper and the throat ID.

Figure 67: These wear conditions affect the function of the slips themselves:

1. The reduced backup area for the slip causes wear and crushing in the backs of the slips.
2. The gripping area of the slips on the pipe is greatly reduced.
3. Slips used under these conditions are easily deformed. Drill pipe damage is likely to occur. Observing the height of set slips in the master bushing is an easy means of checking for wear. The slips ride high in the master bushing when the rotary equipment is in good condition.

Figure 68:

4. As the system wears, slips ride lower in the master bushing.

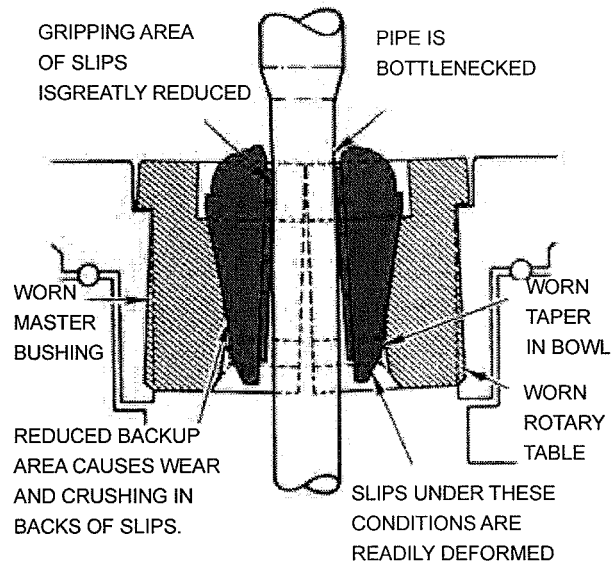


Figure 66: Rotary Equipment Wear Points



Figure 67: Slips Riding High in Master Bushing

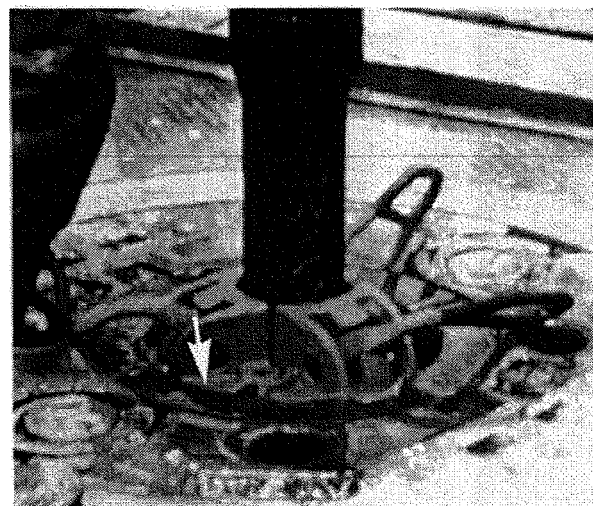


Figure 68: Slips Riding Low in Master Bushing

PAPER TEST: TESTING OF ROTARY EQUIPMENT WEAR

A paper test according to TSEL-0158 is the best way to determine the degree of rotary equipment wear. This test should be performed every three months and each time a new master bushing or slip set is put into service. For accurate results, A RULE OF THUMB: use a hook load of at least 10,000 lbs (4,535 kg) per column.

General procedure

Clean an area of pipe where there are no insert marks. Clean slip inserts with a wire brush.

Figure 69: Wrap a layer of test paper around the cleaned section of pipe. Varco can supply test paper or a layer of mud sack paper will serve the purpose. Use friction tape to hold the paper to the pipe.

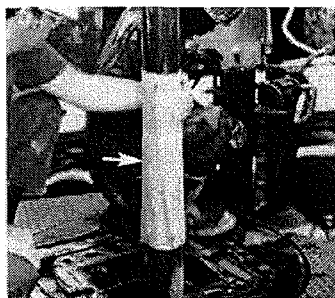


Figure 69: Wrapping Test Paper Around Kelly

Figure 70: Place the slips around the pipe and hold them while the pipe is lowered at normal speed.



Figure 70: Setting Slips

Figure 71: After the slips have been set, hold them firmly around the pipe as it is raised. they should be removed carefully to prevent damage to the paper. Evaluation should be done using the second layer of the paper because the outside layer will have misleading slip impressions.



Figure 71: Removing Slips

Use TSEL-0158 Paper Test for logging the results of the Paper Test.

Recognizing worn equipment and how to solve the problem.

Figure 74: This is a worn split master bushing in a rotary. The space at the top, approximately 1/4 inch (6,5-mm) between these two bushing halves. The space at the bottom however, has increased to more than 3/4 inch (19 mm). This reduces support for the slips and causes drill pipe damage. The white line (see arrow) indicates where the throat of the master bushing was when new.

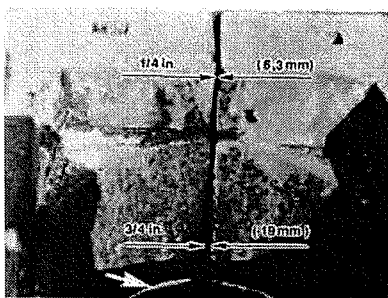
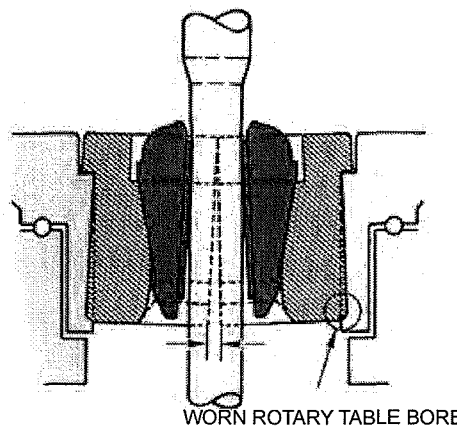


Figure 74: Master Bushing Wear

Figure 75: The increased gap at the bottom, between the master bushing halves, and the lack of slip support shown is not caused by wear in the master bushing, but by wear in the ID of the rotary table.



WORN ROTARY TABLE BORE

Figure 75: Worn Rotary Table Bore. New Standard API Split Master Bushing. Rotary Table Wear

Figure 76: Placing a new split master bushing in the worn rotary will not solve this problem. It can be corrected by removing the rotary and having it built up to original specifications. Repairing the bore of a table is expensive and time consuming, requiring that the complete rotary table be taken out of service, disassembled and repaired.

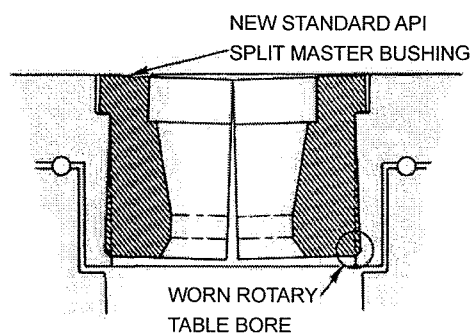


Figure 76: New Bushing and Worn Rotary Table

Figure 77: A second and less expensive solution would be to replace the split master bushing with a solid master bushing which does not depend on the rotary bore for support. The solid master bushing will contain the complete load of the string (and has a capacity of 500 tons). When a master bushing is replaced, the rotary slips must be checked.

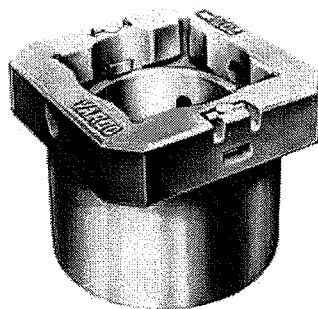


Figure 77: Solid Body Master Bushings

Figure 78 Shows a new master bushing with worn rotary slips. A set of slips conforms or wears in relation to the condition of the master bushing. If a master bushing is worn and must be replaced; it is probable that the slips are also worn, due to improper support from the old bushing. If worn and deformed slips do not receive proper support from the new master bushing, they will cause continued damage to the drill pipe. A worn or bent slip will bend back in a new bushing, causing cracks in the slip body.

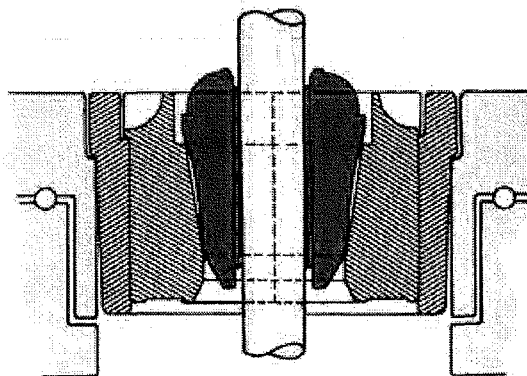


Figure 78: Worn, Deformed Slips in a New Bushing

Square Drive Solid Master Bushing Inspection

Figure 79: Here is a comparison of new and worn conditions for a square drive master bushing and their effects on slip support: the API specification for the throat measurement is 10.1/8 inches (257 mm). The master bushing should be replaced when the measurement reaches 10.5/8 inches (270 mm).

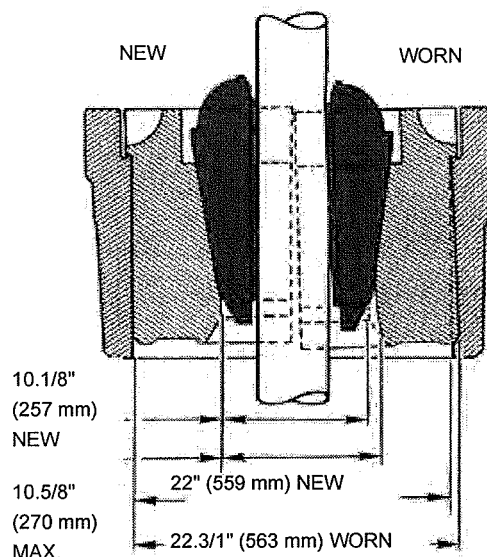


Figure 79 : New and Worn Square Drive Bushings

Figure 80: Due to reduced support in the critical area of a worn master bushing, the slip body will be concentrated in the upper portion of the slip body only, causing bottlenecks of the drill pipe. A similar condition can occur when the ID of the rotary itself is worn beyond the 3/16 inch (4.8 mm) recommended limit.

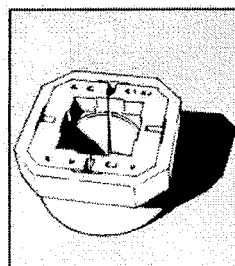


Figure 80: Square Drive Master Bushing with Worn ID

Figure 80 shows a solid master bushing that has been sent in for repair. The first thing that can be noticed is that the bowls are together at the top and open at the bottom. This condition means there is wear on the back of the bowls and inside of the outer hull. While the ID of the top of this hull is correct, inspection shows that the ID at the bottom is worn 3/16 inch (4.8 mm), enough to cause the separation between the bowls.

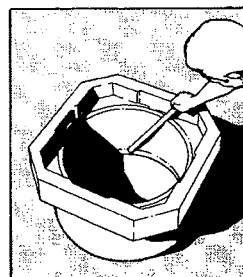


Figure 81: Checking Master Bushing ID

Figure 82: The inspector is checking the taper. The length of the original taper was 8.13/16 inches (224 mm). this is now reduced to approximately 7 inches (178 mm) which amounts to 2 inches (50.8 mm) less support for the rotary slip. Notice the circular line at the end of the rule. This mark indicates tool joint wear.

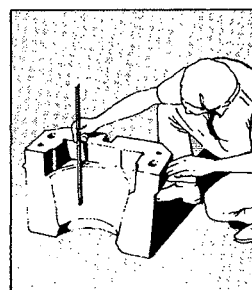


Figure 82: Checking Master Bushing Bowl Taper

Figure 83: Shows the start of the new taper that has been cut by the wear of tool joints which pass through the rotary. The effective backup for the rotary slip has now been reduced to 5 inches (127 mm). When using a long rotary slip, the total length of the slip is 20 inches (508 mm) with 16 1/2 inches (419 mm) of inserts. Working in a bushing with only 5 inches (127 mm) of tapered area for backup will cause the backs of the slips to crush.

Pin-Drive Solid Master Bushing Inspection

Figure 84: Compares new and worn conditions for a pin drive master bushing and the effects on slip support. The API specification for the throat measurement is 10.1/8 inches (257 mm).

Figure 85: The maximum allowable wear has increased to 10.7/8 inch (276 mm). This limit prevents damage to drill collar slips which were designed for the shorter taper of the square drive master bushing. Notice that the toe of the slip has pulled away from the drill pipe. This is due to the combination of wear in the throat area and the outer hull. If the ID of the outer hull were in good condition, the slips would still have good support and proper contact with the drill pipe. Even though there would not be damage to drill pipe, deformities in the drill collar would still occur. 37.1/2" Hinged Master Bushing.

The throat and outer hull wear measurements are the same as the extended bowl. For hinged master bushings, a wear zone must be considered - the hinge pin. Maximum wear is .032 inch (0.8 mm). Beyond this point, conditions similar to wear in the ID of the rotary on a split square drive master bushing will exist, allowing the bushing halves to separate and reduce slip back-up area.

Use a pry bar at the hinged section to move the bushing back and forth, to determine wear. Maximum movement should not exceed 1/16 inch (1.6 mm).

Figure 86-1: As With the square drive bushing, the obvious problem is that the bowls are together at the top and open at the bottom.

Figure 86-2: Shows a pin drive master bushing that has been sent in for repair.

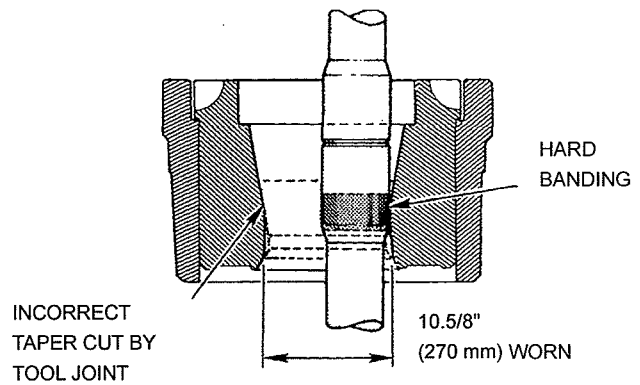


Figure 83: Square Drive Bushing Worn By Tool Joint

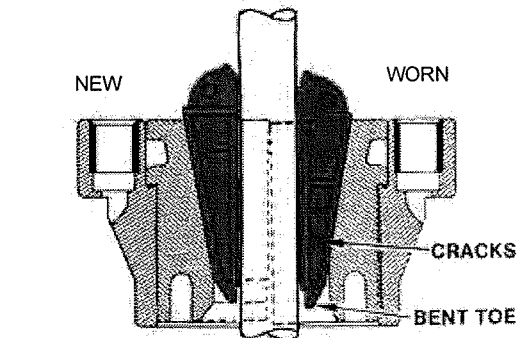


Figure 84: New and Worn Pin Drive Bushings

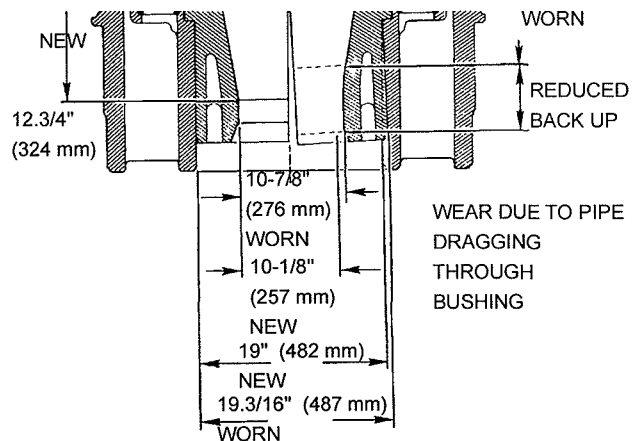


Figure 85: Comparison of New and Worn Hinged Master Bushing

WORN HINGE PIN

(MAX. WEAR OCCURS AT BOTTOM OF PIN)

0.032\"/>

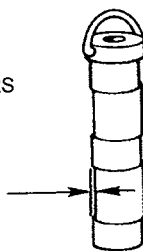


Figure 86-2: Worn I.D.

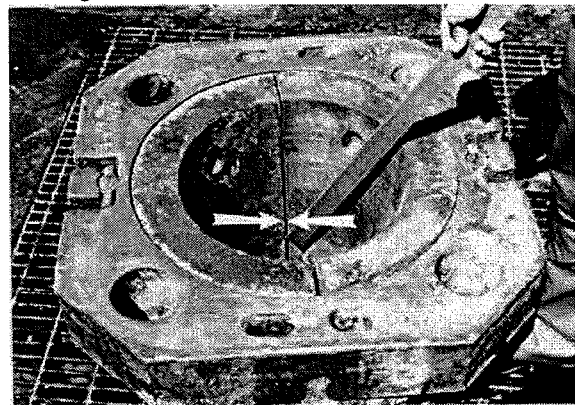


Figure 86-1: Pin Drive Master Bushing tops together

Figure 87: To measure a bushing, first make sure the bowls are pushed back against the hull, measure the throat or the bottom of the taper with calipers as shown here. The manufactured dimension is 10.1/8 inches (257 mm). The recommended maximum wear dimension is 10.7/8 inches (276). The measurement of this bushing is 11.1/16 inches (281 mm) or 3/16 inch (5 mm) over the allowable maximum.

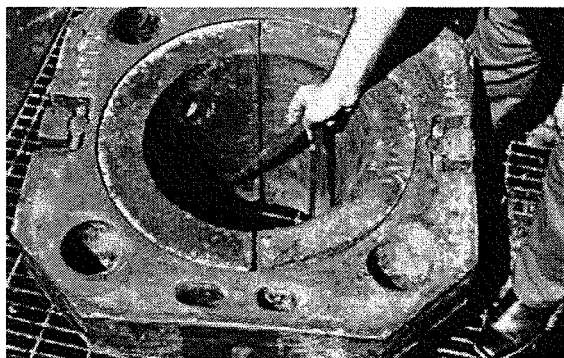


Figure 87: Measuring Master Bushing Throat

Where does all this wear occur?

Figure 88: The inspector is measuring the throat of one insert bowl. The measurement is 10.7/8 inches (276 mm) across the throat. This bowl is worn to the maximum allowable dimension.

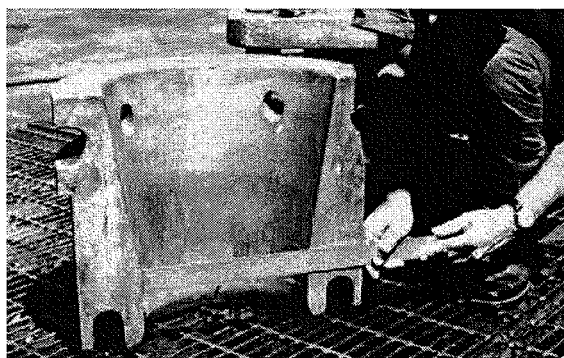


Figure 88: Bowl with Maximum Throat Wear

Figure 89: Pin Drive Bushing Worn by Tool Joint

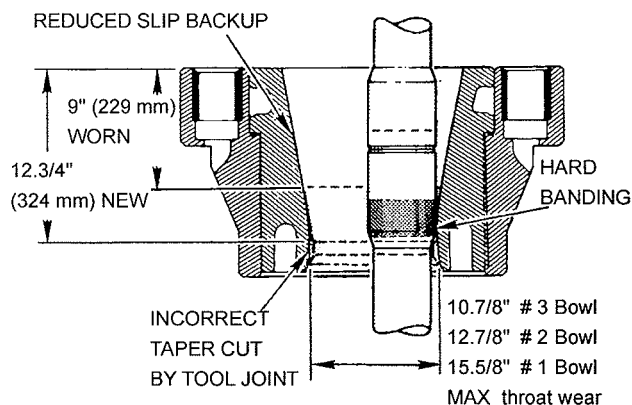


Figure 89: Pin Drive Bushing Worn by Tool Joint

Figure 90: Halfway down the tapered area is a line where the tool joints of the drill pipe have hit the taper and worn a recess in the slip backup area. This wear alone has reduced the area of slip support by 4 inches (101,6 mm).

Inspecting the hull shows there is no measurable wear in the ID of the upper portion. However, wear can easily be seen at the point where the hull extends below the bowls.

With the drill pipe tight against one side of the table, the hard band area of the box will hit the taper 4 inches (101,6 mm) above the throat. the hard band will grind the bowl and cut a second taper.

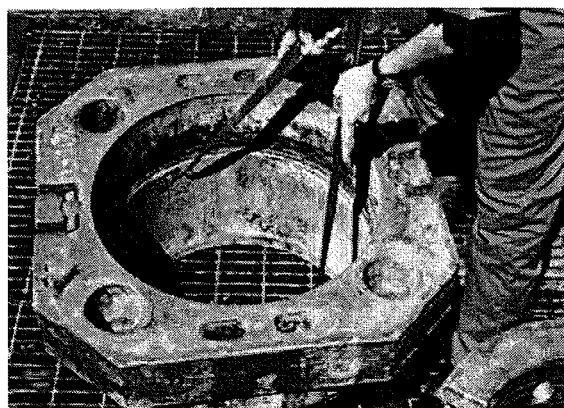


Figure 90: Measuring Master Bushing Upper ID

Figure 91: The lower ID wear is being measured, and the result is 19.3/16 inches (487 mm) or 3/16 inch (5 mm) of wear, which is the recommended maximum allowable wear.

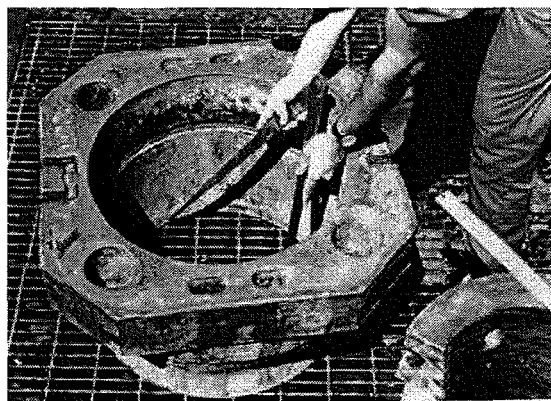


Figure 91: Measuring Wear in Hull lower ID

Figure 92: The combination of wear in the bowls and wear in the ID of the hull have reduced the effective slip support area by almost 50 percent. There is no longer proper support in the critical area of the slip.

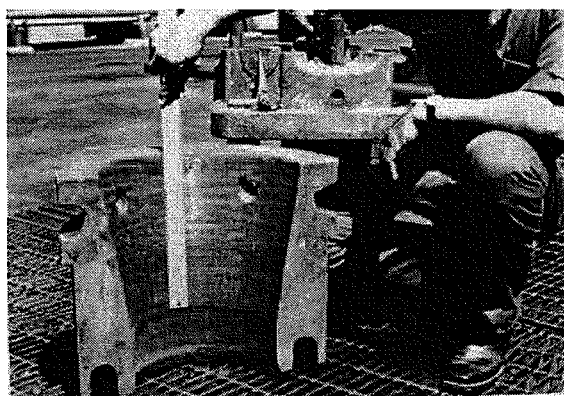


Figure 92 : Worn Out Master Bushing

Drive hole bushing replacement

Figure 93 & 94: After a period of time, the drive holes in the MSPC and MPCH master bushing will become deformed and the bushings in these holes will need replacement.

1. Place new drive hole bushings in a freezer.
2. Cut the worn bushing top to bottom with a torch in two places about 180° apart. Drive out the pieces from the mud drain hole.
3. Clean out the drive holes, remove any rust and deburr the top edge.
4. Preheat the master bushing body around the drive hole bushing area to 400-450° F (205-235° C).e. Remove drive hole bushings one at a time from freezer when ready to install.
5. Make sure master bushing drive hole area is at the proper temperature. Drive the bushing in, using a wooden block on top of it to prevent damage to the bushing. Drive the bushing into the hole as fast as possible with a sledge hammer. If too much time is taken, the bushing will expand in the drive hole and prevent full seating.

TO REPLACE
DRIVE HOLE BUSHING:
TORCH CUT 2 PLACES
180° APART AND DRIVE
OUT FROM DRAIN HOLE

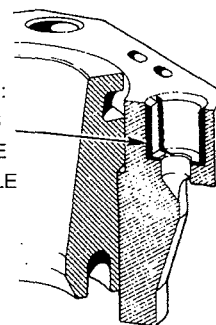


Figure 93: Drive Hole Bushing Removal

DRIVE IN BUSHING
UNTIL FIRMLY SEATED

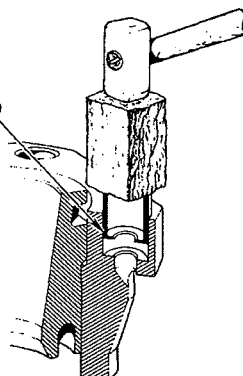


Figure 94: Drive Hole Bushing Replacement

Master bushing parts

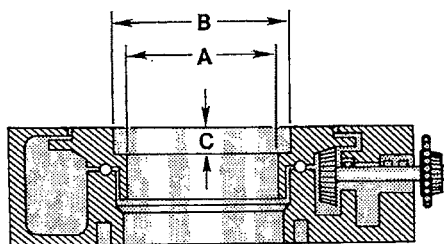


Figure TD-9: API Rotary Table Opening

Table TD-14 API Rotary Table Dimensional Data

		A		B		C	
Reg. Size (Inches)	[inch]	mm	[inch]	mm	[inch]	mm	
17.1/2	17.1/2	445	18.3/16	462	5.1/4	133	
20.1/2	20.1/2	521	21.3/16	538	5.1/4	133	
27.1/2	27.1/2	699	28.3/16	716	5.1/4	133	
37.1/2	37.1/2	953					
49.1/2	49.1/2	1257					

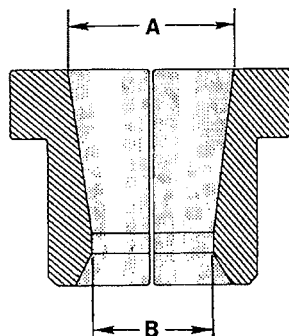


Figure TD-10: API Insert Bowls

Table TD-15 API Insert Bowls Dimensional Data

Reg. Size (inches)	Bowl No	A		B	
		[inch]	[mm]	[inch]	[mm]
2.3/8 - 8.5/8	3	14.3/8	365	10.1/8	257
8.5/8 - 10.3/4	2	16.1/4	413	12.1/4	311
11.3/4 - 13.3/8	1	19	183	15	381

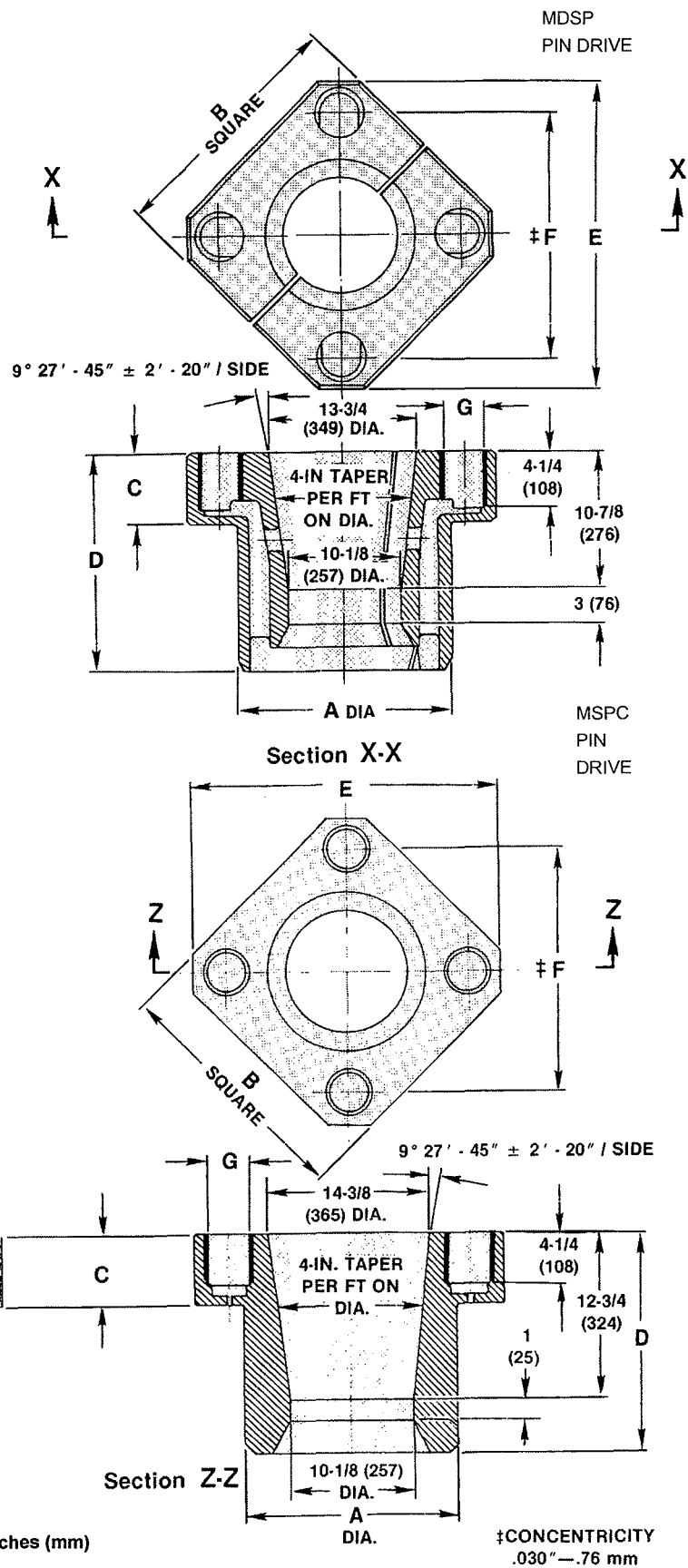


Figure TD-11: Master bushing Dimensions in inches (mm)
(See Next Page for data)

Table TD-16: Varco Rotary Table Master Bushings

Make	Model/Size	A		B		C		D		E	
		[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]
API Standard	17.1/2	**17.7/16	443	18.1/8	460	5.1/4	133	18	457	23	584
	20.1/2	**20.7/16	519	21.1/8	537	5.1/4	133	18	457	27.3/8	695
	27.1/2	**27.7/16	697	28.1/16	713	5.1/4	133	18	457	37	940
Bethlehem	B.175 17.1/2	17.7/16	443	18	457	5.5.1/2	127.140	18	457	24	610
	B.210	20.15/16	532	21.3/8	543	5.5.1/2	127.140	18	457	29	737
	B.21.TA	20.7/8	530	21.1/8	537	4	102	18	457	29	737
	26	25.15/16	659	26.1/8	664	4.1/4	108	18	457	32	813
	B.275	27.3/8	695	28	711	5.5.1/2	127.140	17.1/4	438	36	914
Brewster	OB.18 RSH.18	17.15/16	456	18.7/16	468	4.1/4	108	18	457	24.1/2	622
	RSH.22	21.15/16	557	22.7/16	570	4.1/4	108	18	457	27.1/25	687
	RSH.27.1/2	27.7/16	697	27.5/16	694	4.3/4	121	17.1/4	438	36	914
Continental EMSCO	L.17	16.15/16	430	18.11/16	475	6.1/4	159	18	457	24	610
	*T.1750	17.7/16	443	18.1/8	460	5.1/4	133	18	457	23	584
	0-17.1/2, P-17.1/2	17.7/16	443	18.11/16	475	6.1/8	155	18	457	24	610
	*T.2050	20.7/16	519	21.1/8	537	5.1/4	133	18	457	26.3/4	679
	O-20.1/2 P, PJ, J, JA, JG, JAG, JAGS, JAS, JGS, JS, JAB.20.1/2, JABS.	20.7/16	519	20.3/4	527	5.1/4	133	18	457	26.3/4	679
	JB, JBS	20.7/16	519	20.3/4	527	6.1/2	165	18	457	26.3/4	679
	D-25.1/20A	25.3/8	645	26	660	5.1/4	133	17.1/4	438	32	813
	*T.2750	27.7/16	697	28.1/16	713	5.1/4	133	17.1/4	438	36	914
	G-27.1/2	27.3/8	695	28.1/16	713	5.1/4	133	17.1/4	438	32	813
	H-27.1/2	27.3/8	695	28.1/16	713	6.1/2	165	17.1/4	438	32	813
	K-27.1/2, KS, PJ	27.7/16	697	28.1/16	713	6.1/2	165	17.1/4	438	36	914
Gardner Denver	*RT.17.1/2	17.7/16	443	18.1/8	460	5.1/4	133	18	457	23	584
	RT.22.1/2	22.7/16	570	23.1/8	587	5.1/4	133	18	457	30.1/4	768
	*RT.27.1/2	27.7/16	697	28.1/16	713	5.1/4	133	17.1/4	438	36	914
Haniel & Lueg	*L.17.1/2	17.7/16	443	18.1/8	460	5.1/4	133	18	457	23	584
	S.20	19.5/16	491	20.7/16	519	5.1/4	133	18	457	24	610
	L.25.1/2	25.7/16	646	25.7/8	657	5.1/4	133	17.1/4	438	31	787
Ideco	L.27.1/2	27.7/16	697	28.7/8	987	7	178	17.1/4	438	32	813
	17.1/4	17.31/16	437	19.7/8	505	5	127	18	457	24	610
	17.1/2	17.7/16	443	19.7/8	505	5	127	18	457	24	610
	HS.175 20.1/2	20.7/16	519	21.1/8	537	5.1/4	133	18	457	27.3/8	695
	23	22.15/16	583	26.3/8	670	6.1/4	159	18	457	31	787
	27.1/2 HS.275	27.7/16	697	27.7/8	708	6.1/4	159	17.1/4	438	33.3/4	857
Midcontinent (Unit Rig)	37.1/2	37.7/16	951	38.7/8	987	4.3/8	111	20	508	38.7/8	987
	S.17.1/2 A	17.7/16	443	18.3/8	467	4	102	18	457	*24	610
	S.21 A	20.15/16	532	21.7/8	556	4	102	18	457	29	737
	S.27.1/2 A	27.7/16	697	28.1/16	713	5.1/4	133	17.1/4	438	35	889
National	A&B.175.17.1/2	17.7/16	443	18.1/8	460	5.1/4	133	18	457	23.3/4	603
	A.205 20.1/2	20.7/16	519	21.1/8	537	5.1/4	133	18	457	26.3/4	679
	MS-27.1/2 A & B-27.1/2	27.7/16	697	28.1/16	713	5.1/4	133	17.1/4	438	32	813
	C-365	36.7/16	926	39 dia.	991 dia.	5.1/4	133	20	508	42	1067
Oilwell	C-375	37.7/16	951	40 dia.	1016 dia.	5.1/4	133	20	508	42	1067
	*A.17.1/2	17.3/16	437	18.1/8	460	5.1/4	133	18	457	23	584
	17.1/2	17.7/16	443	18.1/8	460	5.1/4	133	18	457	23	584
	20.1/2	20.7/16	519	20.3/4	527	5	127	18	457	26.3/4	679
	*A.20.1/2	20.7/16	519	21.1/8	537	5.1/4	133	18	457	26.3/4	679
	21 & 21 A Super	20.7/8	530	21.3/8	543	5.1/4	133	18	457	26.3/4	679
	26HD	25.7/8	657	26.7/16	672	5.1/8	130	18	457	33.1/2	851
	27.1/2, 27.1/2 A	27.3/8	695	26.7/16	672	5.1/4	133	18	457	32	813
	*A.27.1/2	27.3/8	695	28.1/16	713	5.1/4	133	17.1/4	438	36	914
	A.37.1/2	37.3/8	949	38.1/16	967	6.1/4	159	20	508	46.3/4	1187
	17.1/2	17.29/64	443	18.7/16	468	4.3/8	111	18	457	21	533
Wirth	20.1/2	20.13/32	518	20.13/16	529	7.1/8	181	18	457	24	610
	*27.1/2	27.7/16	697	28.1/16	713	5.1/4	133	17.1/4	438	36	914
	37.1/2	37.3/8	949	38.1/16	967	6.1/4	159	20	508	46.3/8	1178

Table	F		G	
Size (in.)	[inch]	[mm]	[inch]	[mm]
17.1/2	19	483	2-9116	65
20.1/2 -21	23	584	2-9116	65
23 -49.1/2	25-3/4	654	3-318	86

*API standard Varco solid

**17.3/16" (437 mm)

** 20.1/8" (511 mm)

** 27.3/8" (695 mm)

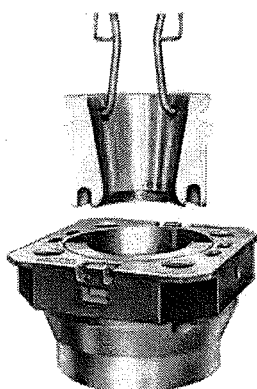
Description	Qty	Size of Rotary Table (inches)			
		17-1/2 Part. No.	20-1/2 & 21 Part. No.	22 & 23 Part. No.	27-1/2 Part. No.
17-1/2	1	1011	1011	1011	1022
20-1/2 -21	2	1013	1014	1014	-
23 - 49-1/2	2	1015	1016	1016	-
	2	1017	1018	1029	-
	1	1021	1021	1021	1021
Insert Bowl No. 1 (split) for 13.3/8 & 11.3/4 OD casing	-	-	-	-	2002
Insert Bowl No. 2 (split) for 10.3/4 & 9.5/8 OD casing	-	-	-	-	1026
Insert Bowl No. 3 (split) ** extended API for 8.5/8 OD and smaller	-	1024	1024	-	1025

Note: * No locking device is used for the insert bowl of these two sizes. When ordering or requesting a quote, please specify make, size and type of rotary table.

Note: ** Special API extended insert bowl for round trips only.

Figure TD-13: 20-1/2 thru 27-1/2 MSPC Solid Body Pin Drive Master Bushings

For 23, 26 and 27-1/2 In. tables - Shown with API extended insert bowl no. 3
Uses Varco 27 HDP Kelly Bushings



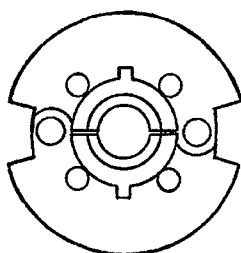
For 20-1/2, 21, and 22-1/2 in. tables - Shown less insert bowls.
Uses Varco 20 HDP Kelly Bushings



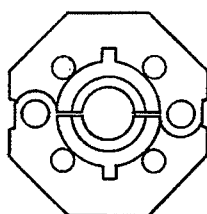
Table TD-19: MSPC- Parts List

No.	Description	Qty.	Weight	
			[lbs]	[kg]
20 1/2, 21, 22 AND 22 1/2 IN. ROTARY TABLES				
1809	Insert Bowl NO.3 (Split) Extended API	1	464	210,5
1013	Eccentric Pin	2	1	0,5
1811	Lock	2	1-1/2	0,68
1028	Retaining Pin for Lock Pin	2	1/4	0,11
1813	Drive Hole Bushings	4	3-1/2	1,6
1021	Lifting Sling	1	40	18,1
1815	Bit Breaker Adapter Plate	1	137	62,1
1902	Insert Bowl No.2 (Split) for 10-3/4 & 9-5/8 in. casing	1	242	109,7
23, 26, 27-1/2 IN. ROTARY TABLES				
1810	Insert Bowl NO.3 (Split) Extended API.	1	620	281,3
1014	Eccentric Pin		2	2,9
1016	Lock	2	3	1,4
1018	Retaining Pin for 23 and 26 in	2	1/4	0,11
1030	Retaining Pin for 27-1/2 in	2	1/3	0,14
1814	Drive Hole Bushings	4	7	3,2
1021	Lifting Sling	1	40	18,1
1816	Bit Breaker Adapter Plate	1	220	99,8
1903	Insert Bowl No. 1 (split) for 13.3/8 & 11.3/4 inch. casing	1	326	147,9
1904	Insert Bowl No. 1 (split) for 10.3/4 & 9.5/8 inch. casing	1	460	208,7

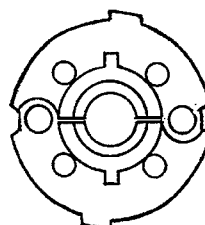
Note: Split Pin Drive Master Bushing for 27-1/2 In. Rotary Tables available on Special order only... P/N 5429



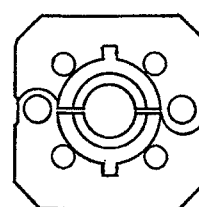
CONTINAL
EMSCO



IDECO



NATIONAL



OILWELL

Table TD-20 MSPC: Ordering Information

Manufacturer	Table Size (inches)	w/ No. 3 Bowl, sling & BB adapter			w/o No. 3 Bowl, sling & BB adapter		
		Part No.	Weight		Part No.	Weight	
			[lbs]	[kg]		[lbs]	[kg]
API	20-1/2	1801-1	1210	549	1805-1	570	259
	27-1/2	1804-1	1965	892	1808-1	1110	459
	T2050	1801-1	1210	549	1805-1	570	259
EMSCO	20.1/2J, JA, JAS, JC, JAC, JACS, JCS	1801-3	1210	549	1805-1	570	259
	T2750	1804-1	1965	892	1808-1	1110	459
	27-1/2 H	1804-2	1965	892	1808-2	1110	459
	27-1/2K, KS, PJ	1804-3	1965	892	1808-3	1110	459
OILWELL	A20-1/2	1801-1	1210	549	1805-1	570	259
	20-1/2	1801-3	1210	549	1805-3	570	259
	A27-1/2	1804-1	1965	892	1808-1	1110	459
	27-1/2 & 27-1/2A	1804-9	1965	892	1808-9	1110	503
Super Oilwell	21A	1801-2	1210	549	1805-2	570	259
National	20.1/2	1801-1	1210	549	1805-1	570	259
	27.1/2	1804-5	1965	891	1808-5	1110	503
	20.1/2	1801-1	1210	549	1805-1	570	259
IDECO	23	1802-1	1210	549	1806-1	646	293
	27.1/2	1804-7	1965	891	1808-7	1110	503
Gardner-Denver	RT-22.1/2	19334-1	1210	549	19333	570	259
Unit Rig	27.1/2	1804-1	1965	891	1808-1	1110	503
	27.1/2	1804-4	1965	891	1808-4	1110	503
Bethlehem	B275	1804-6	1965	891	1808-6	1110	503
Brewster	27.1/2	1804-8	1965	891	1808-8	1110	503

MPCH Master bushings

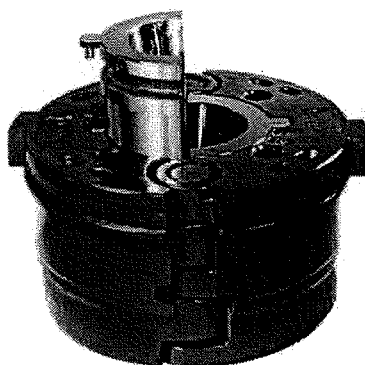


Figure TD-14: MPCH Hinged Pin Drive Master Bushing

Table TD-21: MPCH Parts List

Part. No.	Description	Qty.	Weight	
			[lbs]	[kg]
6608	Insert Bowl NO.3 (Split) Extended API.	1	625	283.5
6604	Hinge Pin, removable	1	80	36.3
6605	Hinge Pin, stationary w/lube fitting	1	75	34
6606	Hinge Pin Retainer.	1	3 oz.	0.06
1014	Eccentric Pin	2	2	0.9
50106-22	Eccentric Pin Retainer.	2	2 oz.	0.06
1016	Lock	2	3	1.4
3699	Drive Hole Bushing w/ locking pocket.	4	7	3.2
6699	Lifting Sling	1	150	68
1816	Bit Breaker Adapter Plate	1	220	99.8
6610	Insert Bowl No.1 (Split) for 13.3/8 and 11.3/4 casing	1	336	152.4
6609	Insert Bowl No.2 (Split) for 10.3/4 and 9.518 casing	1	470	213.2

Note: When ordering or requesting a quote, please specify size, make and model of rotary table.

Table TD-22: MPCH-Ordering Information

Manufacturer	Table size	w/ No. Bowl, sling & BB adapter			w/o No. Bowl, sling & BB adapter		
		Part. No	Weight		Part. No	Weight	
			[lbs]	[kg]		[lbs]	[kg]
EMSCO	37.1/2 (S/N 1-48)	6600-2A	4325	1961.8	6601-2A	3325	1508.2
	37.1/2 (S/N 49 up) to 49.1/2	6600-2	4149	1882	6601-2	3149	1428.4
Oilwell	37.1/2 to 49.1/2	6600-3	4245	1925.5	6601-3	3245	1471.9
IDECO	37.1/2	6600-4	4015	1821.2	6601-4	3015	1637.6
National	36.1/2	6600-5	3910	2095.8	6601-5	2905	1317.7
	37.1/2 to 49.1/2	6600-1	4029	1827.5	6601-1	3029	1373.9
Wirth	37.1/2 to 49.1/2	6600-3	4245	1925.5	6601-3	3245	1471.9

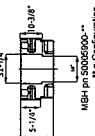
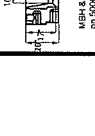
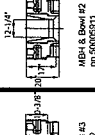
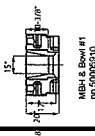
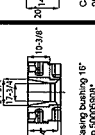
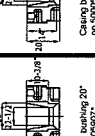
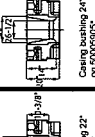
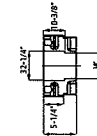
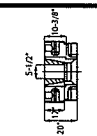
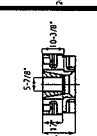
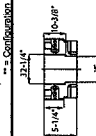
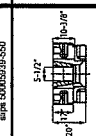
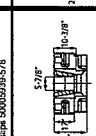
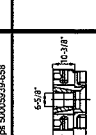
Overview of Master Bushings, casing bushings and insert bowls for handling tubular goods

Rotary Table Size	TUBULAR GOODS OUTSIDE DIAMETER	2.3/8" - 3.5/8" Insert bowl No.3	9.5/8" - 10.3/4" Insert bowl No.2	11.3/4" - 13.3/8" Insert bowl No.1	16"	18.5/8" - 20"	22" - 23"	24-1/2" - 24	26"	30"
SLIP TYPE		Slip type to be selected from tables in this book or from the Rotary and Handling Tools Catalog								
BUSHING TYPE	CB*	MPCH*	MSPC*	CUL	CB	MSP*	CU	Solid Table Adapter		
37.1/2"										
37.1/2"										
27.1/2"										
27.1/2"										
27.1/2"										
27.1/2"										
20.1/2-17.1/2"										
37.1/2"										

* Configuration according to tables.

Overview of MBH1250 & LSB1000 & LSB1250 Master Bushings, Landing String Bushing & Slips

Overview of Baash-Ross 200 Ton Casing Spiders & UC-3 Slips

Rotary Table Size	TUBULAR GOODS OUTSIDE DIAMETER	5 1/2"	5 7/8"	6 5/8"	2 3/8"-7 5/8" Insert bowl No.3 Suitable for SDS, SDML, SDXL & SDHL Rotary Slips w/ standard API taper	9 5/8"-10 3/4" Insert bowl No.2	11 3/4"-13 3/8" Insert bowl No.1	16"	20"	22"	24"
BUSHING TYPE		Suitable for CMS-XL, DCS & CP-S Casing Slips									
49 1/2"	MBH1250										
49 1/2"	MBH + LSB1000 w/ 1000 sT slip										
49 1/2"	MBH + LSB1250 Dress w/1250 sT bushing										

*Dimensions to be verified upon ordering

CASING OUTSIDE DIAMETER →

Spider Size & P/N	16"	18-5/8"	20"	22-1/2"	24"	26"	30"	33"	36"	42"
30" 7704-A-161	UC-3 slip 7704-5036 Bushing 7704-A-165 Retainers 50012-148-8	UC-3 slip 7704-5035 Bushing 7704-A-164 Retainers 50012-50-8	UC-3 slip 7704-5034 Bushing 7704-A-164 Retainers 50012-50-8	UC-3 slip 7704-5002 Bushing 7704-A-163 Retainers 50012-38-C8	UC-3 slip 7704-5001 Bushing 7704-A-163 Retainers 50012-38-C8	UC-3 slip 7704-5006 Bushing 7704-A-162 Retainers 50012-26-C8	Use 30" Spider			
36" 7704-A-167		UC-3 slip 7704-5035 Bushing 7704-A-172 Retainers 50012-76-8	UC-3 slip 7704-5034 Bushing 7704-A-172 Retainers 50012-76-8	UC-3 slip 7704-5002 Bushing 7704-A-171 Retainers 900041-441	UC-3 slip 7704-5001 Bushing 7704-A-171 Retainers 900041-441	UC-3 slip 7704-5006 Bushing 7704-A-170 Retainers 900042-186	UC-3 slip 7704-5005 Bushing 7704-A-169 Retainers 50012-32-C8	UC-3 slip 7704-5008 Bushing 7704-A-168 Retainers 50012-20-C8	Use 36" Spider	
42" 7704-A-179							UC-3 slip 7704-5007 Bushing 7704-A-180 Retainers 900042-708		UC-3 slip 7704-5019 Bushing 7704-A-178 Retainers 50012-36-C8	Use 42" Spider

Load capacity of bushings and slips

Non of the mentioned slips or bushings are load rated, except for the SDHL-slips and the BAASH-ROSS 200T Spider . They are however manufactured according to and comply to API 7K.

⚠ WARNING: The listing below is an indication. Actual capacity depends on various pipe parameters like crushing load, wall thickness, wear of bowl/slips etc.

Type	Capacity / Load [s Ton]						
	200	250	350	500	750	1000	1250
Baash-Ross 200 ton HCS with UC-3 slips							
30" CUL / CB with CMS-XL							
27.5 MSPC							
37.5 MPCH							
37.5 MPCH with SDHL 750 T rated slips							
MBH1250							
MBH Casing Bushing 24" with CMS-XL							
MBH Casing Bushing 22" with CMS-XL							
MBH Casing Bushing 20" with CMS-XL							
MBH Casing Bushing 16" with CMS-XL							
MBH #1 Insert Bowl (11.3/4" - 13.3/8")							
MBH #2 Insert Bowl (9.5/8" - 10.3/4")							
MBH #3 Insert Bowl (2.3/8" - 8.5/8") with SDHL slip							
LSB1000 Landing String Bushing with LSS1000 slip							
LSB1250 Landing String Bushing with LSS1250 Dual Upset slip							

MBH1250 Hinged master bushing

For the safe handling of heavy weight casing strings (including bit) in combination with the corresponding landing strings, a new series of rotary equipment, with a dedicated rating and safety factor, has been developed.

- Casing sizes up to 24", string weights up to 1,000 sTon.
- 5.1/2" to 6.5/8" landing strings with dedicated drill pipe, string weights up to 1,250 sTon.
- Dual upset drill pipe, string weight up to 1,250 sTon.
- All standard pipe types and sizes with special #1, #2 and #3 master bushing bowls, string weights up to 1,000 sTon.
- Standard bit breaker plates. Maximum bit diameter 29.1/2".

Casing bushings

Height and internal diameters/tapers of casing bushing are 100% identical to standard NOV Varco BJ 24" CB16542 casing bushing. Interfaces with standard 24" CMS-XL casing slips.

Drilling bowls

Interfaces with standard API handslips featuring a 4" / ft taper.

When removed from MBH1250, a 29.1/2" diameter bit can pass through MBH1250, without the need to remove the MBH1250 from the rotary table, due to throat opening of 30".

These bowls feature the standard MPCH bit breaker holes. Standard bit breaker plates, Kelly bushings, etc, fit into these holes. Interfaces with same torque backup blocks in MBH1250 as above mentioned casing bowls for torque backup an assembly.

LSB1250 landing string bushing

To handle 1,000 sTon capacity landing strings, the MBH1250 can be dressed with the LSB1000 Landing String Bowl. Combined with the Special Design Landing String Hand Slips, the landing string can be run up to loads of 1,000 sTon. The Landing String Slips grip the pipe with standard inserts. Customers should always perform a crushing load calculation to determine the ultimate safe working load of the system.

To handle 1,250 sTon capacity landing strings, the MBH1250 can be dressed with the LSB1250 Landing String Bowl. Combined with the Special Design Landing String Hand Slips, the landing string can be run up to loads of 1,250 sTon. The 1,250 sTon capacity can only be achieved with landing strings with "dual upset" connections, i.e. the joint has two 18 degree tool joints. A 1,250 sTon capacity BX style elevator will be connected to the upper tool joint, while the lower tool joint is suspended in the LSB1250 with special slips that have an 18 degree contour in the slips, rather than inserts.



Figure 124: MBH1250 with drilling bowl and slips

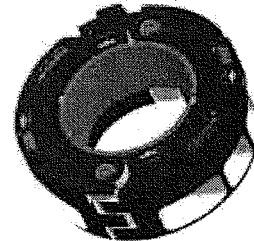


Figure 125: MBH1250 with casing bushing

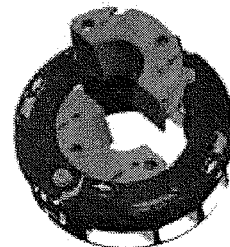


Figure 126: MBH1250 with drilling bowl

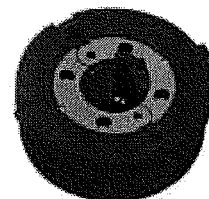


Figure 127: MBH1250 with LSB1250 landing string bushing and LSS1250 landing string slip

LSB MASTER BUSHING PARTS

MBH1250 Master bushing hinged

Name	Part number
Master Bushing Hinged for National 49.1/2" table	50005900-1
Master Bushing Hinged for Continental Emsco 49.1/2"	50005900-2
Master Bushing Hinged for Oilwell 49.1/2'	50005900-3

Casing bushings

Description	Partnumber
Casing bushing for 24"	50005905
Casing bushing for 22"	50005906
Casing bushing for 20"	50005907
Casing bushing for 16"	50005908

Drilling bowls

Description	Partnumber
MBH bowl #1 - 11.3/4" - 13.3/8"	50005910
MBH bowl #2 - 8.5/8" - 10.3/4"	50005911
MBH bowl #3 - 2.3/8" - 8.5/8"	50005912

LSB1000 - Landing string bushing & slips

Partnumber	Description
50005920	LSB1000 - Landing String Bushing 1000 ton capacity
50005939-658	Landing String Slip for Grant Prideco Slip Proof 6.5/8" pipe
50005939-578	Landing String Slip for Grant Prideco Slip Proof 5.7/8" pipe
50005939-550	Landing String Slip for Grant Prideco Slip Proof 5.1/2" pipe



Figure 128: LSS1000 landing string slip

LSB1250 - Dual upset landing string bushing

Partnumber	Description
50005940	LSB1250 - Dual Upset Landing String Bushing 1250 ton capacity
50005940-658	Landing String Slip for Dual Upset Landing String 6.5/8" Special Taper
50005940-578	Landing String Slip for Dual Upset Landing String 5.7/8" Special Taper
50005940-550	Landing String Slip for Dual Upset Landing String 5.1/2" Special Taper

LSS1250 Landing String Slips

Name	Part number
Grant Prideco H-6.5/8" pipe having a 7.1/8" clamping diameter	50005925-1

MASTER BUSHINGS

HAND SLIPS



SLIPS

SDS, SDML, SDHL AND SDXL ROTARY SLIPS

These models are for use in API standard insert bowls. These slips feature improved contact on drill pipe through a superior wrap around configuration and unique insert design that helps to prevent bottle necking and gouging damage. The buttress design of the body segments provides great strength while minimizing weight for ease of handling.

Rotary slips provide long and trouble free service under the most severe conditions. Inserts are held securely in dovetail slots and are easily changed by removing the nuts, bolts, and retainer at the top of the slots.

- Minimum operating temperature of the slips according to API 7K: 0° C / 32° F
 - SDHL Slips are rated to a maximum of 750 sTon.
1. The MPCH master bushing and bowl #3 used with SDHL handslip can take the 750 Ton. NOV recommends to use the SDHL in applications with increased drilling depths and on floaters specifically.
 2. Handslips except for SDHL do not have a rating
 3. CMSXL have a welded in insert seat. As a ball park figure use about 30 tons per segment provided that the pipe can withstand the crushing. In a lot of cases is the pipe the limiting factor.

Figure 95: SDS-Short Rotary Slips

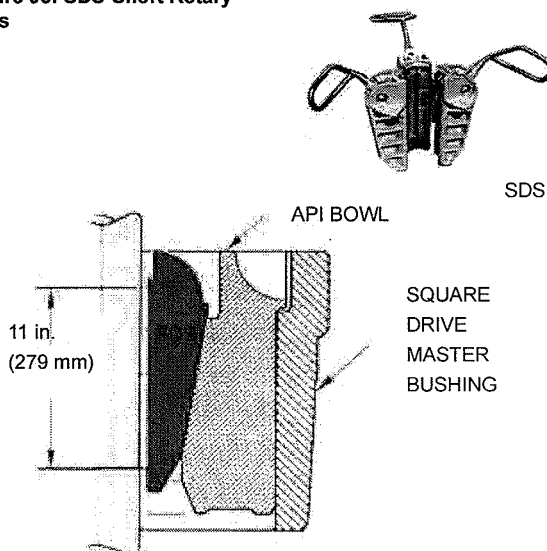


Figure 96: SDS Grip Length

Figure 99: SDXL- Extra Long Rotary Slips

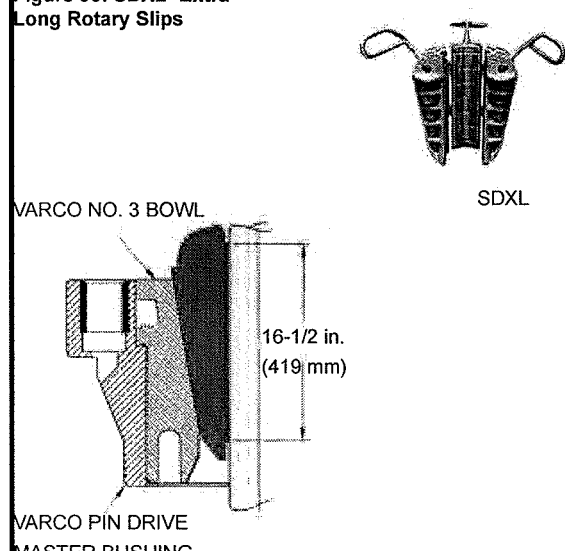


Figure 100: SDXL Grip Length

Figure 97: SDML-Medium Rotary Slips

Figure 98: SDML Grip Length and Insert Bowl Contact

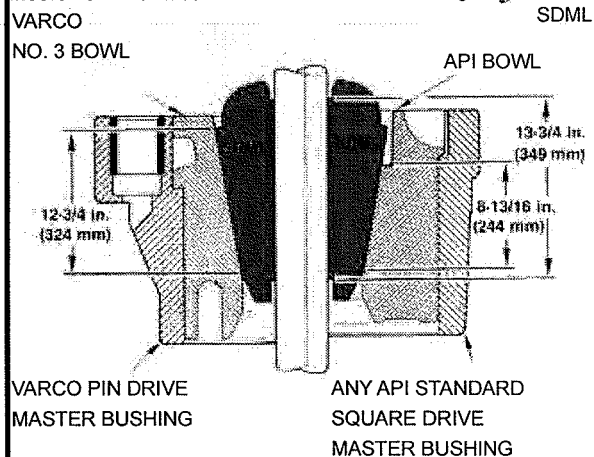
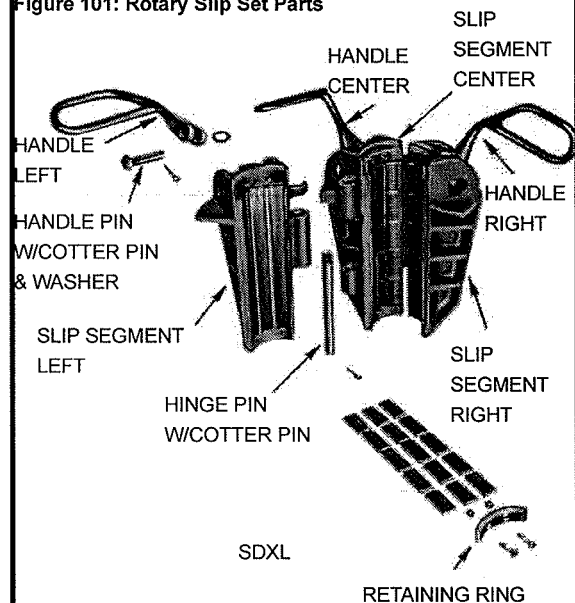


Figure 101: Rotary Slip Set Parts



Varco DCS drill collar slips

Figure 102-104: Varco DCS slips provide superior holding power under all conditions. Each segment, manufactured from a rugged drop forging, has an extra long back to give maximum support to the circular button gripping elements. Full wrap-around design compensates for irregularities in wear. Circular buttons hold against load from all directions to assure positive holding and slip setting. Drill collar slips are flat on top to accommodate the MP Clamp.

Figure 102: DCS-Multi-Segment Drill Collar Slips

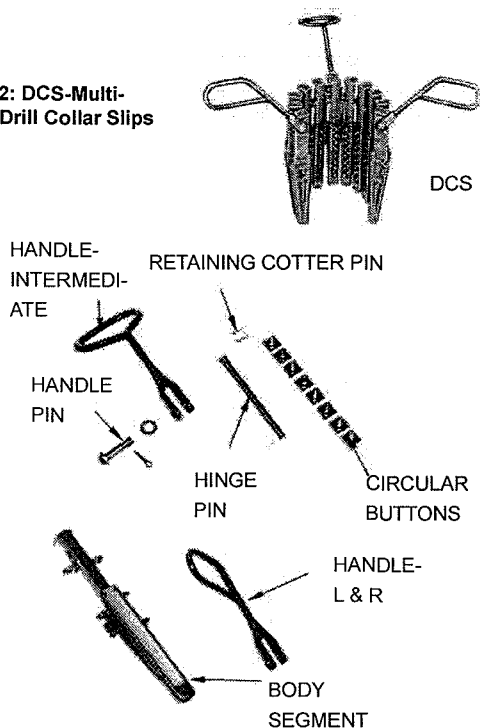


Figure 103: DCS-Multi-Segment Drill Collar Slips Parts

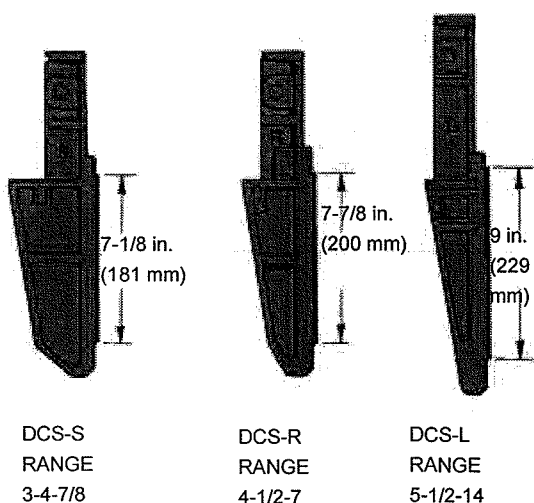


Figure 104: DCS-Drill Collar Slip Grip Lengths

CMS-XL Casing slips

Figure 103-108: CMS-XL slips will handle the longest casing strings currently being set. Manufactured from drop forgings, their reinforced design will stand up to the most severe service. The self-centering, full wrap-around grip holds positively while preventing damage - even to thin wall casing. By varying the circular button size and adding or removing body segments, casing from 6-5/8 to 30 inches OD can easily be accommodated. Light and easy to handle, Varco CMS-XL casing slips provide unsurpassed quality.

Figure 105: CMS-XL-Casing Slips

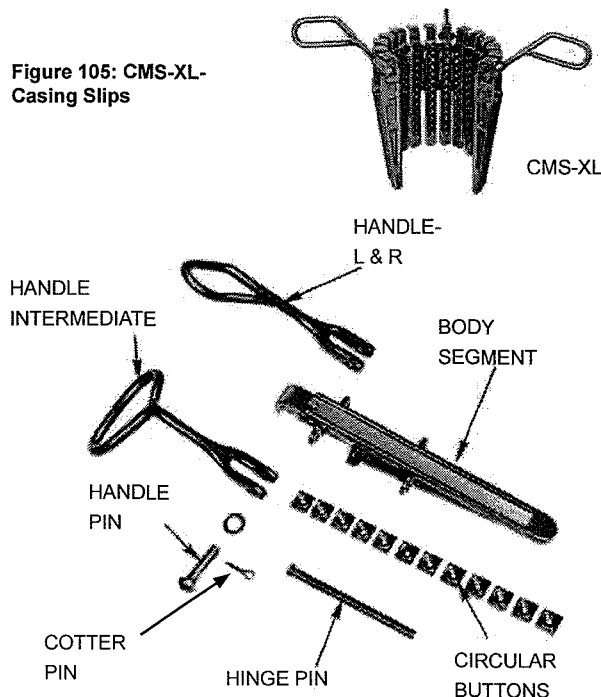


Figure 106: CMS-XL-Casing Slips Parts

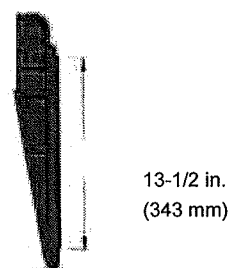


Figure 107: CMS-XL-Casing Slip Grip Length

CP-S Conductor pipe slips

CP-S slips are used in offshore or locations when conductor pipe is used. These slips are available in three models to handle conductor pipe with OD's of 24, 26 or 30 inches (610, 660 or 762 mm).

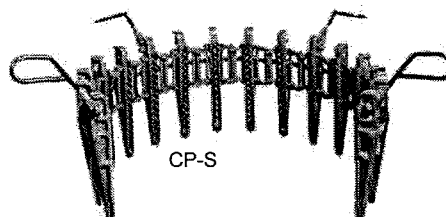


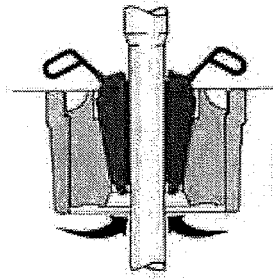
Figure 108: CP-S-Conductor Pipe Slips

OPERATION OF SLIPS

The industry has had many accidents caused by slips being set on moving pipe. The drill pipe must be stopped completely before the slips are set on the pipe. The driller should look at the weight indicator to see that he is holding the full load. If the bit should hit a ledge which supports part of the weight of the string, when the elevator is removed the pipe could be jarred free and the full shock load dumped on the slips. When the shock load hits the slips, the drill string acts like a rubber band. A 15,000 foot (4,572 m) string of 4.1/2 inch drill pipe can stretch approximately 38 feet (11 m). The string will start to bounce and could cause the slips to be thrown out of the rotary table; then the pipe will be dropped in the hole.

Figure 113: If the pipe does not go in the hole and the slips do hold, another problem could occur; the drill pipe is could be permanently deformed and cracked just below the slips, resulting in wash-outs. Do not set slips on larger size pipe than they were designed to hold.

Proper use of rotary slips



OVERSTRESSED OR "STRETCHED" PIPE

Figure 113: Stopping Pipe With Rotary Slips

Figure 114: This shows the effects of using slips on the wrong size pipe. When 5 inch slips for example, are used on 5 inch pipe, the inserts have the proper contour. If the slip is used on larger pipe or on tool joints, the stress is placed on the outside corners of each segment. This causes the slip bodies to spread and crack. After the slip has been used on larger pipe and then placed on the pipe size for which it was designed, the slip bodies will conform to their original contour. This could cause the slips to break and allow pieces to fall into the hole.

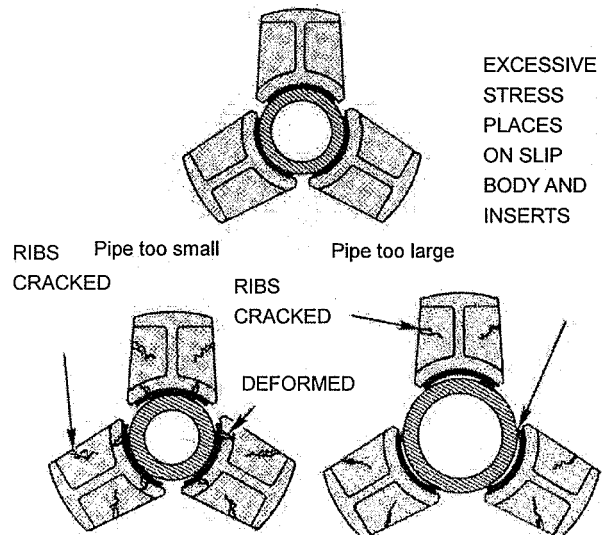


Figure 114: Incorrect Use of Rotary Slips

Figure 115: If drill collar slips are used on collars with recessed areas, care should be taken in setting. If set partially on the upset area, the insert and insert slot will be damaged, making it difficult, if not impossible, to change inserts. The retaining screw or cotter pin area, could be damaged so that it will be difficult to remove.

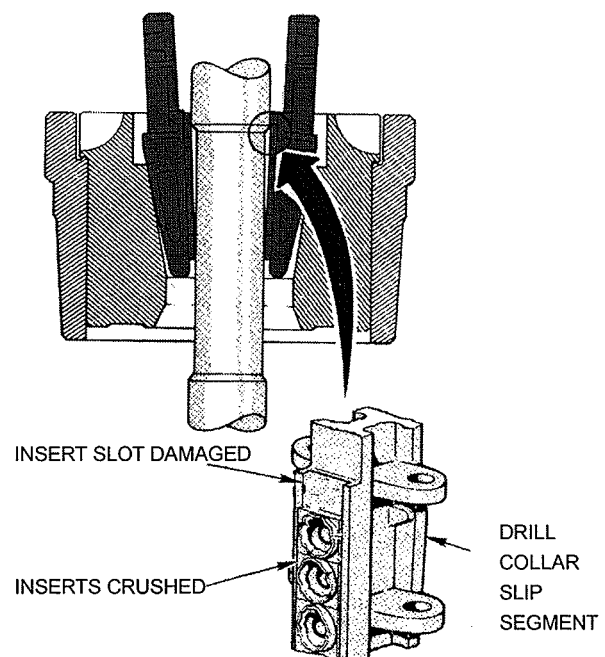


Figure 115: Results of Improperly set Drill Collar Slips

Figure 116: One final word of caution: There are times when setting the slips that the driller does not pick up enough to get the rotary slips around the pipe. In this case the top of the rotary slips are on the tool joint. When the drill pipe is lowered, the slip's body is bridged between the master bushing and the pipe. This causes the back of the slips to bend. The normal reaction is to raise the string and let the slip segment settle around the pipe. The bent slip segments will bend back to their original form, however, cracks may have developed in the bodies of the slip. As a result of this, the toe of the slips could break and fall into the hole. If the driller runs into slips, inspect it or use a new set until the damaged slip can be inspected properly.

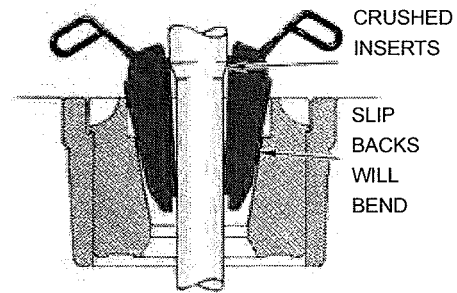


Figure 116: Setting Slips on Tool Joint

Combined use of rotary slips and safety clamps

The DCS type slips are to be used when running Drill Collars. The setting procedure is as with any other slips; the driller will lower the string to the point where the hand slips are due to be set, at this point the drill will stop lowering and the slips can be clamped around the pipe in the bowls. The driller will then transfer the string weight from the elevator to the slips by slowly lowering the blocks.

On those occasions where the driller collar will slip thru the slips, or as an added safety device, a dog collar or safety clamps can be used above the slips. The DCS type slips are fitted with a flat on top of each segment. This flat spot is there to provide a landing area for the safety clamp. The working of a safety clamp is to push the slips further into the bowl, and thereby forcing the slips to better grip the drill collar, in case of pipe slippage. The safety clamp is not a rated device, and if used properly it will only see a fraction of the string weight, as the string weight is supported in the slips.

NOV recommends to use a safety clamp in those instances where the DC is slipping thru the slips and never use a sledge hammer to force DCS (or any type of slips) to better grip the string.

MAINTENANCE OF SLIPS

Inspection & Maintenance schedules & criteria can be found in the back of this chapter.

Cleaning and Lubrication

Figure 117: Clean the inside taper of the drilling bowls removing any abrasive material. Lubricate the inside taper of the drilling bowls frequently with grease to prevent slips from sticking in the bowls. It is suggested that the outside surface of the bowl and the inside diameter of the hull be cleaned and well lubricated. This will allow the bowls to move up slightly when the drill pipe is picked up. At this time, either the rotary slip will release between the backs and the taper of the bowl, or the rotary slip together with bowl, will move up a short distance until the bowl hits the lock, which will then free the slips. If this area between the bowls and the master bushing is kept clean and well lubricated, the slips will not stick in the master bushing.

Recommended grease

Use a EP-1 or EP-2 grease, or use Autol TOP2000 grease. Oil the insert backs and dovetail slots using only a light grade of machine oil or grease with EP-2 grease.

Warning: Never use pipe dope to grease the back of the slips.

Dressing Slips and Insert Bowls

Figure 118: The slips and bowl ID should be dressed as well as cleaned to prevent sticking of the slips. Abrasive materials in the drilling mud can cause horizontal lines of wear in the mating surfaces of the slips and bowls.

Dressing these surfaces, using an up and down motion with emery cloth will result in the grain of the two parts running with each other to significantly reduce friction.

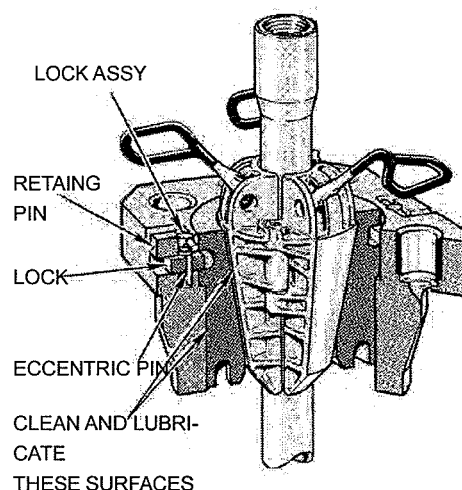


Figure 117: Rotary Slips in Position

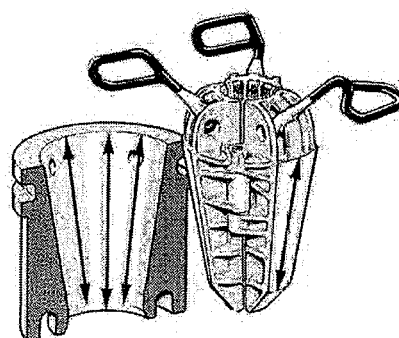


Figure 118: Surfaces that Require Dressing

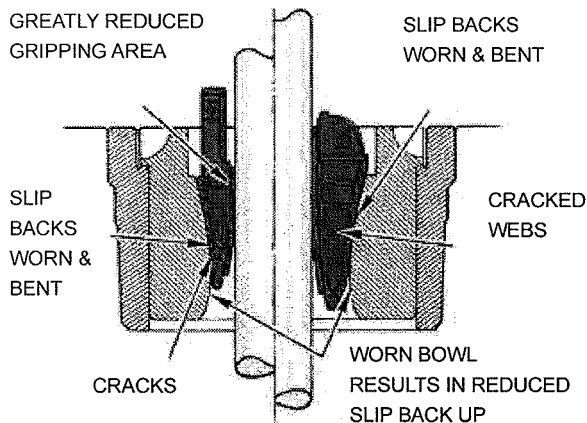


Figure 119: Bent, Worn, Slips

SLIPS INSPECTION

Figure 120: Periodic inspections should be performed on drill pipe and drill collar slips as a preventive measure.

Areas of particular concern are slip segment hinges and the hinge pins. Placing a straight edge against the backs and inside face of the slips will indicate if they are bent or worn. A good slip back is straight, smooth, and well greased.

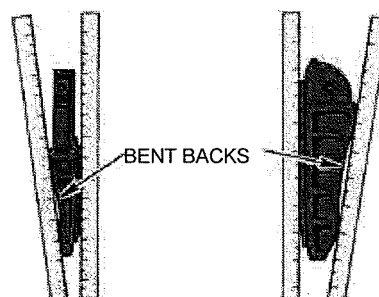


Figure 120: Checking Slip Segments

Figure 121: Webs and toes of slips can develop cracks from excessive wear or from use in a badly worn bushing. If cracks are present, destroy the slips and remove them from the site. If cracked slips are kept in service, parts could break off and fall into the hole.

Figure 122: Slips segment hinges should be inspected regularly to see that the hinge pin is locked into position with the cotter pin and not worn or cracked. Slips that sag or flop over when standing alone on the rig floor, are extremely worn in the hinge area. Pull these hinge pins and check for straightness. A bent hinge pin will indicate oversize hinge pin holes. Oversize hinge pin holes are cause for replacing the slips. If not replaced, wear will increase at an accelerated rate until the slips do not sit correctly in the master bushing. This could damage drill pipe.

Figure 123: Check inserts and insert slots for damage and wear. When the insert slots are badly worn, danger of losing an insert down the hole exists. Replace the slips before a costly failure occurs. Slips should be replaced when there is over 1/8 inch to 3/16 inch (3.2 to 4.8 mm) clearance between the back of the inserts and the insert slot.

TRANSMITTING TORQUE

Warning: It is not allowed using rotary hand slips to transmit torque.

Rotary slips are designed to support string weight and not transmit torque or a combined string weight and torque. It is impossible to determine that combined load of string weight and torque that would not cause failure of the slips. Rotary handslips (except SDHL) are not rated and the string load they can hold depends on on the operational conditions.

Points to keep in mind

1. Replace worn or defective equipment.
2. Stop the drill pipe completely before the slips are set on the pipe. The driller should look at his weight indicator to see that he is holding the full load.
3. Test the slips every three months.

In this handbook we have presented the proper inspection and maintenance procedures required for trouble-free operation and maximum service life of your rotary equipment. Become familiar with these procedures, and put them into operation. Inspection procedures can be found in the back of this chapter.

The continuing search for energy requires highly sophisticated equipment and crews trained to operate and care for it properly.

If this information is put to use, the result will be less "downtime" and more productive hours spent "turning to the right."

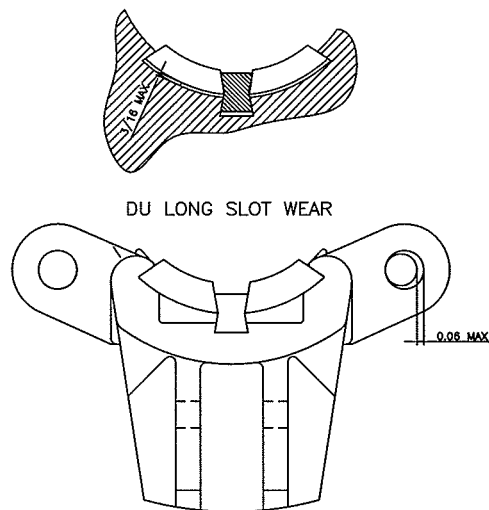


Figure 120A: Du Long Slip Segment Pin Hole Wear

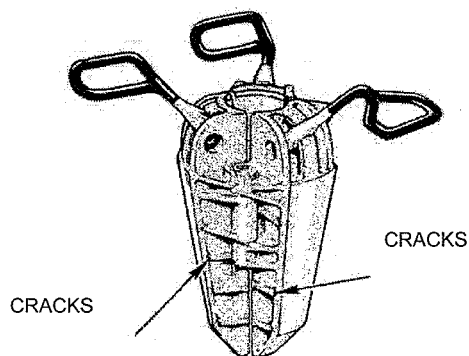


Figure 121: Slip Segment Damage

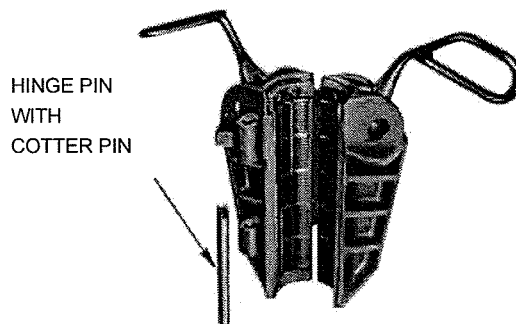


Figure 122: Hinge Pin Removal

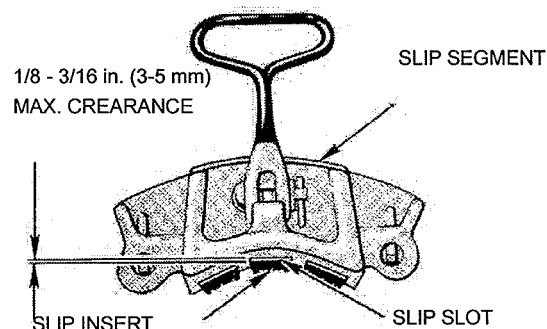


Figure 123: Slip Segment (shown without retaining ring)

SLIP PARTS

SDS: Short Rotary Slips

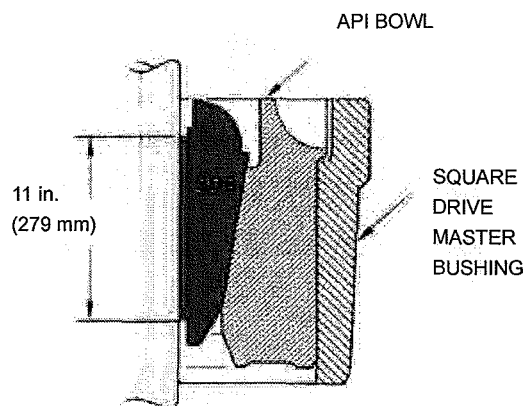
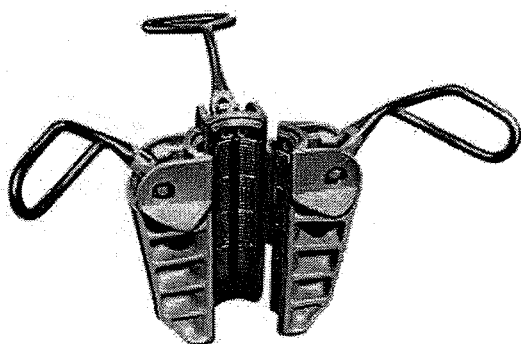


Figure TD-15: SDS-Short Rotary Slips

Table TD-26: SDS Ordering Information

Slip Body Size [inches]	3 1/2		4 1/2		5 1/2	
API Pipe Size OD [inches]	2 3/8	2 7/8	3 1/2	3 1/2	4	4 1/2
Part No.: Slip complete w/inserts	3901	3903	3905	3907	3909	3911
Weight: Slip complete w/inserts [lbs / (kg)]	134 (60.3)	128 (52)	124 (56.2)	162 (74)	155 (70.3)	146 (66.2)
INSERTS						
Set: Part No	2160*	2161*	2162.24*	2163*	2164*	2165.36*
Weight [lbs (kg)]	21 (9.5)	17 (7.6)	11 (4.9)	32 (14.5)	25 (11.3)	16 (7.3)

* Kits contain bevelled inserts.

Table TD-27: SDS-Short Rotary Slips Parts List

Part No.	Qty	Part No	Weight		Part No.	Weight	
			[lbs]	[kg]		[lbs]	[kg]
Slip Segment. Right**	1	19306	28	12.7	19311	37	16.8
Slip Segment - Center**	1	19307	32	14.5	19313	39	17.7
Slip Segment. Left**	1	19305	28	12.7	19315	37	16.8
Handle. Right	1	3767	3 1/2	1.6	3767	3 1/2	1.6
Handle. Center	1	3766	4	1.8	3766	4	1.8
Handle. Left.	1	3768	3 1/2	1.6	3768	3 1/3	1.5
Handle Pin w/Washer & Cotter Pin	3	3769	1/2	0.2	3769	1/2	0.2
Hinge Pin w/Cotter Pin	2	2190	1 1/4	0.6	2190	1 1/4	0.6
Retaining Ring	3	3738	1 1/4	0.6	3739	1 1/4	0.6
Kit, Hex Nuts, Bolts & Wrench	1	3737	1/2	0.2	3737	1/2	0.2

** slip segments are not available separately

SDML: Medium Rotary Slips

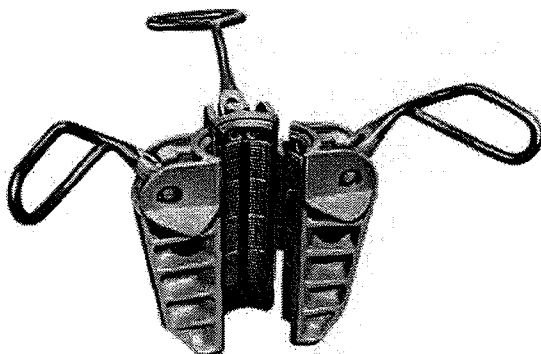


Figure TD-16: SDML-Medium Rotary Slips

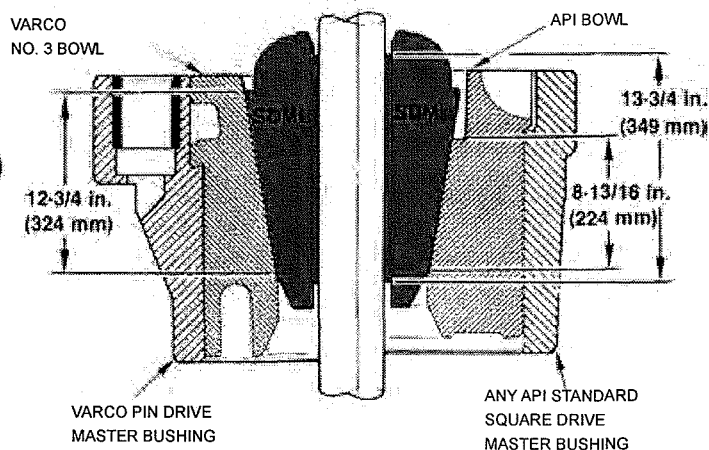


Table TD-28: SDML Ordering Information

Slip Body Size [inches]	3.1/2			4.1/2		
API Pipe Size OD [inches]	2.3/8	2.7/8	3.1/2	3.1/2	4	4.1/2
Part No.: Slip complete w/inserts	15524	15523	15522	15563	15564	15565
Weight: Slip complete w/inserts [lbs (kg)]	193 (87.5)	188 (85.3)	180 (81.6)	207 (94)	199 (90.3)	188 (85.3)
INSERTS * Set: Part No	2160-30	2161-30	2162-30	2163-45	2164-45	2165-45*
Weight [lbs (kg)]	26 (11.8)	21 (9.5)	13 (5.9)	39 (17.7)	31 (14.1)	20 (9)
Slip Body Size [inches]	5			5.1/2		
API Pipe Size OD [inches]	4	4.1/2	5	4.1/2	5	5.1/2
Part No.: Slip complete w/inserts	15567	15568	15569	15571	15572	15573
Weight: Slip complete w/inserts [lbs (kg)]	204 (92.5)	196 (88.9)	185 (84)	200 (90.9)	185 (84)	181 (82.1)
INSERTS * Set: Part No	2168-45	2166-45	2167-45	2168-45	2169-45	2170-45 *
Weight [lbs (kg)]	39 (17.7)	31 (14.1)	20 (9)	39 (17.7)	31 (14.1)	20 (9)

* Kits contain bevelled inserts.

Table TD-29: 3-1/2 and 4-1/2-in. SDML Parts List

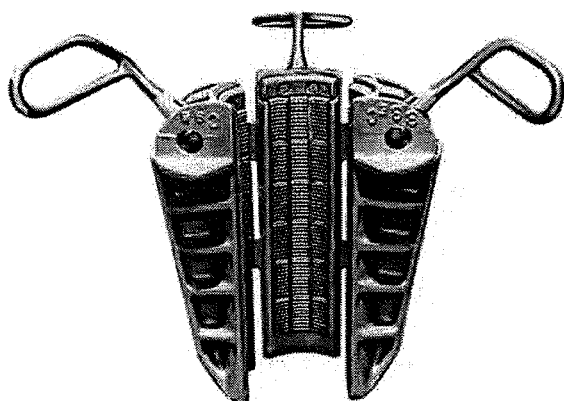
Part No.	Qty	Part No.	Weight		Part No.	Weight	
			[lbs]	[kg]		[lbs]	[kg]
Slip Segment. Right	1	15526	50	22.7	15529	51	23.1
Slip Segment. Center	1	15525	53	24	15528	54	24.5
Slip Segment -Left	1	15527	50	22.7	15530	51	23.1
Handle -Right	1	3767	3.1/2	1.6	3767	3.1/2	1.6
Handle -Center	1	3766	4	1.8	3766	4	1.8
Handle -Left	1	3768	3.1/2	1.6	3768	3.1/2	1.6
Handle Pin w/Washer & Cotter Pin	3	3769	1/2	0.2	3769	1/2	0.2
Hinge Pin w/Cotter Pin	2	2192	1.1/4	0.6	2192	1.1/4	0.6
Retaining Ring	3	3738	1.1/4	0.6	3739	1.1/4	0.6
Kit, Hex Nuts, Bolts & Wrench	1	3737	1/2	0.2	3737	1/2	0.2

Note: **6 required for this one only

Table TD-30: 5 and 5-1/2 in. SDML Parts List

Part No.	Qty	Part No.	Weight		Part No.	Weight	
			[lbs]	[kg]		[lbs]	[kg]
Slip Segment -Right.	1	1532	50	22.7	15535	49	22.2
Slip Segment -Center	1	15531	53	24	15534	52	23.6
Slip Segment -Left...	1	15533	50	22.7	15536	49	22.2
Handle -Right.	1	3767	3.1/2	1.6	3767	3.1/2	1.6
Handle -Center	1	3766	4	1.8	3766	4	1.8
Handle -Left	1	3768	3.1/2	1.6	3768	3.1/2	1.6
Handle Pin w/Washer & Cotter Pin	3	3769	1/2	0.2	3769	1/2	0.2
Hinge Pin w/Cotter Pin	2	2192	1.1/4	0.6	2192	1.1/4	0.6
Retaining Ring	3	3741	1.1/4	0.6	3740	1.1/2	0.7
Kit, Hex Nuts, Bolts & Wrench	1	3737	1/2	0.2	3737	1/2	0.2

SDXL: Extra Long Rotary Slips



VARCO NO. 3 BOWL

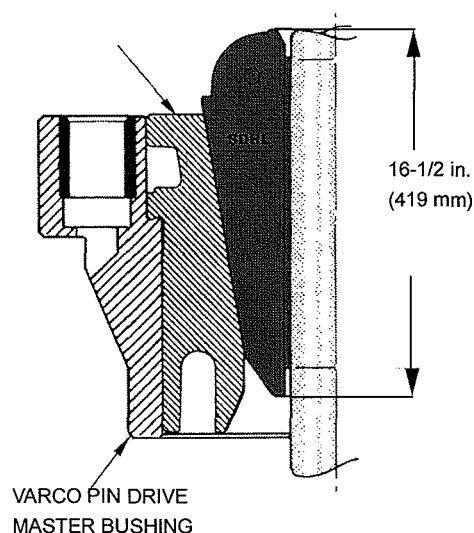


Figure TD-17: SDXL-Extra Long Rotary Slips

Table TD-31: SDXL Ordering Information

Slip Body Size [inches]	3.1/2			4.1/2		
API Pipe Size OD [inches]	2.3/4	2.7/8	3.1/2	3.1/2	4	4.1/2
Part No.: Slip complete w/inserts	-	-	-	V15515	15514	V15513
Weight: Slip complete w/inserts [lbs (kg)]	-	-	-	229 (103.9)	219 (99.3)	205 (93)
INSERTS						
Set: Part No	2160-36	2161-36	2162-36	2163-54	2164-54	2165-54*
Weight [lbs (kg)]	32 (14.5)	25 (11.3)	16 (7.3)	47 (21.3)	37 (16.8)	23 (10.4)
API Pipe Size OD [inches]	4	4.1/2	5	4.1/2	5	5.1/2
Part No.: Slip complete w/inserts	15518	15517	V15516	15521	15520	V15519
Weight: Slip complete w/inserts [lbs (kg)]	237 (107.5)	227 (103)	213 (96.6)	234 (106.1)	224 (101.5)	210 (95.3)
INSERTS Set: Part No	2168-54	2166-54	2167-54*	2168-54	2169-54	2170-54*
Weight [lbs (kg)]	47 (21.3)	37 (16.8)	23 (10.4)	47 (21.3)	37 (16.8)	23 (10.4)
Slip Body Size [inches]	7					
API Pipe Size OD [inches]	5.7/8	6.5/8	7			
Part No.: Slip complete w/inserts	86722-1	86720	86719			
Weight: [lbs (kg)]	252 (114)	242 (110)	232 (106)			
INSERTS Set: Part No	2656-60	2172-60*	2173-60*			
Weight [lbs (kg)]	47 (21.3)	41 (18.6)	26 (11.8)			

* Kits contain bevelled inserts.

Table TD-32: 4-1/2 and 5 in. SDXL Parts List

Slip body size [inches]	4 1/2				5			
Description			Weight				Weight	
	Qty	Part. No.	[lbs]	[kg]	Part. No.	[lbs]	[kg]	
Slip Segment- Right	1	15552	54	24.5	15558	53	24	
Slip Segment -Center	1	15553	57	25.9	15559	55	24.9	
Slip Segment- Left	1	15554	54	24.5	15560	53	24	
Handle- Right.	1	3767	3.1/2	1.6	3767	3.1/2	1.6	
Handle- Center	1	3766	4	1.8	3766	4	1.8	
Handle -Left.	1	3768	3.1/2	1.6	3768	3.1/2	1.6	
Handle Pin w/Washer & Cotter Pin	3	3769	1/2	0.2	3769	1/2	0.2	
Hinge Pin w/Cotter Pin	2	2192	1.1/4	0.6	2192	1.1/4	0.6	
Kit, Hex Nuts, Bolts & Wrench	1	3737	1/2	0.2	3737	1/2	0.2	

Table TD-33: 5 1/2 and 7 in. SDXL Parts List

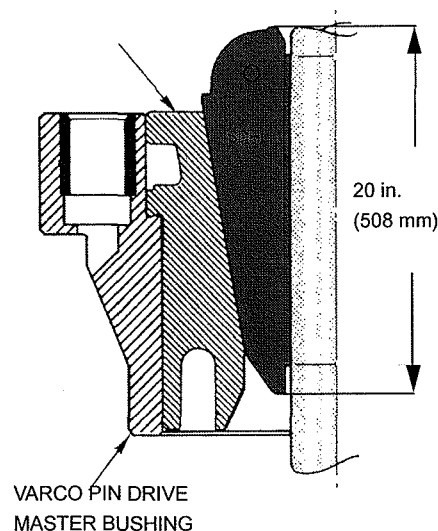
Slip body size [inches]	5 1/2				7			
Description			Weight				Weight	
	Qty	Part. No.	[lbs]	[kg]	Part. No.	[lbs]	[kg]	
Slip Segment -Right	1	15555	56	25.4	86715	56	25.4	
Slip Segment -Center	1	15556	61	27.7	86717	61	27.7	
Slip Segment -Left	1	15557	56	25.4	86716	56	25.4	
Handle -Right.	1	3767	3.1/2	1.6	3767	3.1/2	1.6	
Handle -Center	1	3766	4	1.8	3766	4	1.8	
Handle -Left	1	3768	3.1/2	1.6	3768	3.1/2	1.6	
Handle Pin w/washer	3	3769	1/2	0.2	37691	1/2	0.2	
Hinge Pin w/cotter pin	2	2192	1.1/4	0.6	2192	1.1/4	0.6	
Insert retaining screw w/ washer	9	3745	1/3	0.15	3745	1/3	0.15	
Kit, Hex Nuts, Bolts & Wrench	1	3737	1/2	0.2	3737	1/2	0.2	

SDHL: Rated Extra Long Rated Rotary Slips

VARCO NO. 3 BOWL



Figure: SDHL-Rated Slips w/ load rings



The SDHL-slips are rated for 750 Short Tons, and are the recommended slips in applications with increased drilling depths and on floaters specifically.

Table: SDHL Ordering Information

Slip Body Size [inches]	5.1/2			6.7/8"	
API Pipe Size OD [inches]	4.1/2"	5"	5.1/2"	5.5/8"	5.3/4
Part No.: Slip complete w/inserts	50006021-450	50006021-500	50006021-550	50006040-463	50006040-575
INSERTS	2168	2169	2170	2521	2656
Qty	45	45	45	60	60
LOAD RINGS	50006033	50006033	50006033	50006038	50006038
Qty	6	6	6	6	6
Slip Body Size [inches]	6.7/8"				
API Pipe Size OD [inches]	5.7/8	6	6.3/8	6.5/8	6.7/8
Part No.: Slip complete w/inserts	50006040-588	50006040-600	50006040-638	50006040-663	50006040-688
INSERTS Set: Part No	2632	2650	2652	2655	2173
Qty	60	60	60	60	60
LOAD RINGS	50006038	50006038	50006038	50006038	50006038
Qty	6	6	6	6	6

5.1/2 and 6.7/8 in. SDHL Parts List

Slip body size [inches]	5.1/2		6.7/8	
Description	Qty	Part. No.	Part. No.	
Slip handle, center	1	3766	1	3766
Slip handle pin	3	3769-1	3	3769-1
Washer, 3/4"	3	50812-N	3	50812-N
Cotter pin, 5/16" x 1.1/4"	5	51405-10	5	51405-10
Center slip, 5.1/2" SDHL	1	50006019	1	50006029
Retaining ring	1	3740	1	3742
Cap Flat Head Screw, 3/8" - 16x1.3/4"	6	50606-14-C	6	50606-14-C
Self Locking Nut 3/8"	6	51806-C	6	51806-C
Hinge pin	2	2192-1	2	2192-1
Left Slip, 5.1/2" SDHL	1	50006020	1	50006030
Slip handle, straight	2	3765	2	3765
Right Slip, 5.1/2" SDHL	1	50006018	1	50006028
Load ring, 5.1/2" SDHL	6	50006033	6	50006038
Cotter pin, 3/16" x 1.1/2" SS	12	51403-12-S	12	51403-12-S

VARCO BJ Rotary hand slip product enhancements

Flex handles

Available for all Varco BJ rotary hand slips (SDS, SDML, SDXL and SDHL).

Can be assembled on rotary hand slips without any modification.

Protection Horn on top of the handle provides guard to crew hands, should elevator be lowered too much.

The elastomer section allows the handle to bend. Handle will recover to it's original shape.

Reduces bend and broken handles. Bent handles do not give crew hands an ergonomically lifting position.

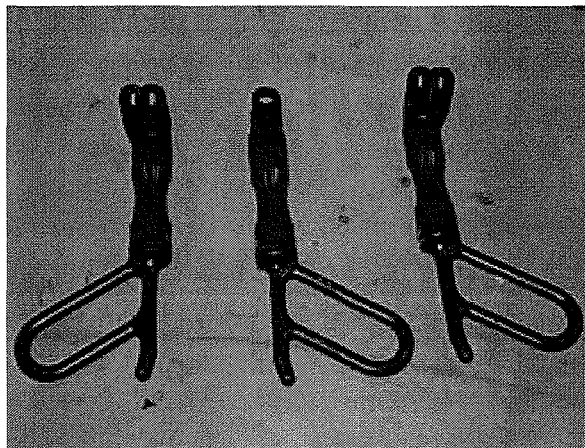


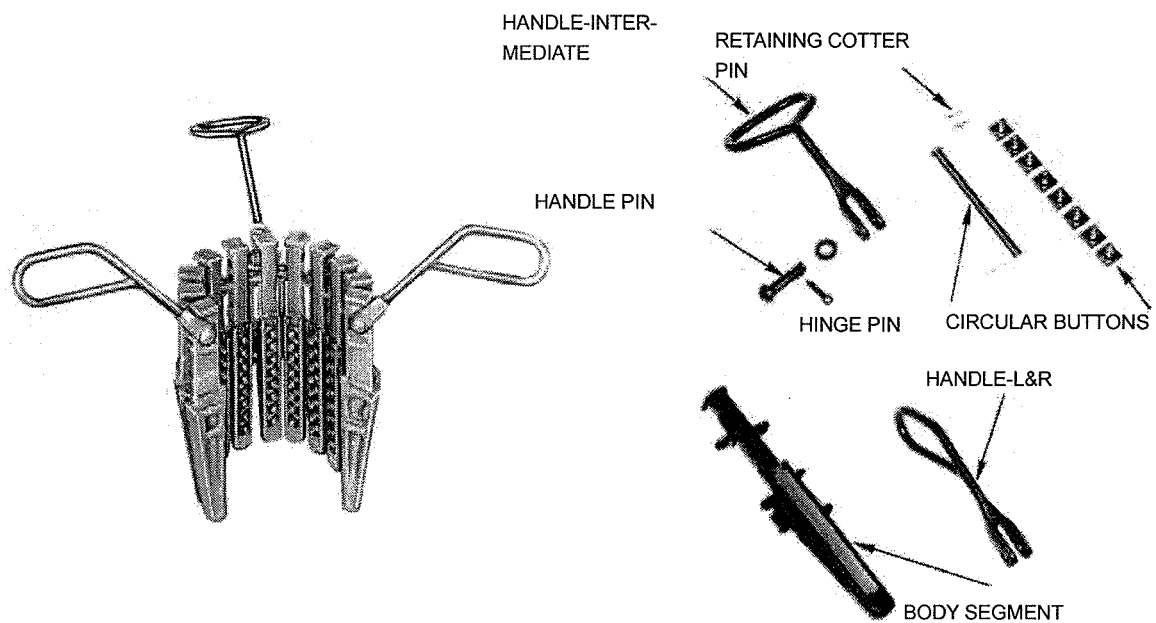
Figure: Flex handles

Part numbers Slips with Flex handles

Slip size [inches]	Pipe size [inches]	SDS pn	SDML pn	SDXL pn	SDHL pn
3.1/2	2.3/8	3901-FH	15524-FH		
	2.7/8	3903-FH	15523-FH		
	3.1/2	3905-FH	15522-FH		
4.1/2	3.1/2	3907-FH	15563-FH	V15515-FH	
	4	3909-FH	15564-FH	15514-FH	
	4.1/2	3911-FH	15565-FH	V15513-FH	
5	4		15567-FH	15518-FH	
	4.1/2		15568-FH	15517-FH	
	5		15569-FH	V15516-FH	
5.1/2	4.1/2		15571-FH	15521-FH	50006021-450-FH
	5		15572-FH	15520-FH	50006021-500-FH
	5.1/2		15573-FH	V15519-FH	50006021-550-FH
6.7/8	5.5/8				50006040-563-FH
	5.7/8				50006040-588-FH
	6.5/8				50006040-663-FH
	6.7/8				50006040-688-FH
7	6.5/8			86720-FH	
	7			86719-FH	

Note: eliminate -FH when ordering slips with regular handles

Drill collar slips



DCS-Multi-Segment Drill Collar Slips

DCS-Multi-Segment Drill Collar Slips Parts

DCS-Drill collar slip grip lengths

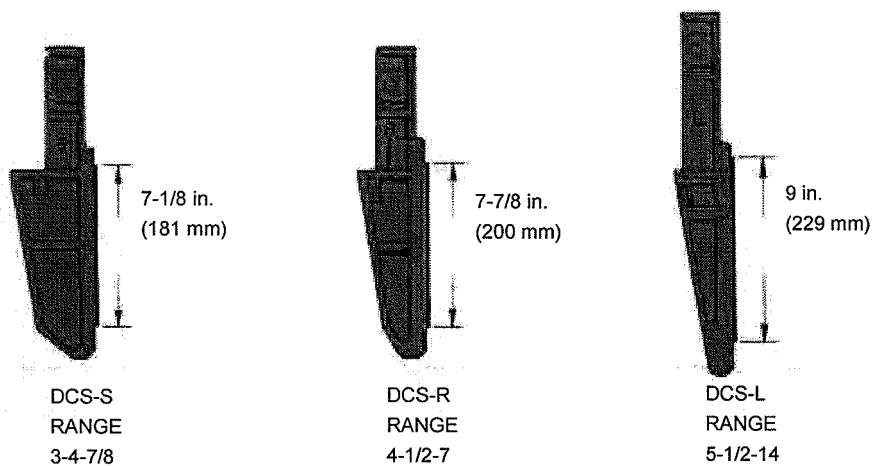


Figure TD-18: DCS-Drill Collar Slips

Table TD-34: DCS-S Drill Collar Slip Parts List

Description	Part. No.	Weight	
		[lbs]	[kg]
Segment-Right End	2568	11	5
Segment-Left End	2569	11	5
Segment-Intermediate	2570	11	5
Hinge Pin w/Cotter Pin	2525	-	-
Handle Pin w/Washer & Cotter Pin	3769	1/2	0.2
Handle for Right & Left End Segment	3765	3.1/2	1.6
Handle for Intermediate Segments	3766	4	1.8
Retaining Cotter Pin	71936	1 oz	28 g
Retaining Screw w/Lock Washer	3748	-	-

Table TD-35: DCS-R Drill Collar Slip Parts List

Description	Part. No.	Weight	
		[lbs]	[kg]
Segment-Right End	2554	10	4.5
Segment-Left End	2555	10	4.5
Segment-Intermediate	2556	10	4.5
Hinge Pin w/Cotter Pin	2525	-	-
Handle Pin w/Washer & Cotter Pin	3769	1/2	0.2
Handle for Right & Left End Segment	3765	3.1/2	1.6
Handle for Intermediate Segments	3766	4	1.8
Retaining Cotter Pin	71936	1 oz	28 g
Retaining Screw w/Lock Washer.	3748	-	-

Table TD-36: DCS-L Drill Collar Slip Part List

Description	Part. No.	Weight	
		[lbs]	[kg]
Segment-Right End	2510	12	5.4
Segment-Left End	2511	12	5.4
Segment-Intermediate	2512	12	5.4
Hinge Pin w/Cotter Pin	2520	3/4	0.3
Handle Pin w/Washer & Cotter Pin	3769	1/2	0.2
Handle for Right & Left End Segment.	3765	3.1/2	1.6
Handle for Intermediate Segments	3766	4	1.8
Retaining Cotter Pin	71936	1 oz	28 g
Retaining Screw w/Lock Washer.	3748	-	-

Table TD-37: DCS Ordering Information

Description	Slip Type, Size, Range (OD, inches)				
	DCS-S	DCS-R	DCS-L		
	3 - 4	4 - 4.7/8	4 1/2 - 6	5 1/2 - 7	6.3/4 - 8 1/4
PIN, Slip complete w/Circular Buttons	2572	2573	2552	2550	2503
Weight, complete Set, [lbs (kg)]	112 (51)	103 (47)	120 (54)	112 (51)	154 (70)
Total number of Segments	7	7	9	9	11
Total number of Intermediate Segments	5	5	7	7	9
Total number of Hinge Pins	6	6	8	8	10
Use in Insert Bowl number			API or No. 3		

Description	Slip Type, Size, Range (OD, inches)				
	DCS-S	DCS-R	DCS-L		
	8 - 9 1/2	8 1/2 - 10	9 1/4 - 11 1/4	11 - 12.3/4	12 - 14
PIN, Slip complete w/Circular Buttons	2507	2530	2508	2534	2536
Weight, complete Set, [lbs (kg)]	173 (78)	185 (84)	198 (90)	256 (116)	237 (107)
Total number of Segments	12	13	14	17	17
Total number of Intermediate Segments	10	11	12	15	15
Total number of Hinge Pins	11	12	13	16	16
Use in Insert Bowl number	No. 3	No. 2	No. 2	No. 1	No. 1

Note: * This size is furnished with 4 handles

All Varco DCS Drill Collar Slips have an API taper of 4 in./ft on the diameter.

Table TD-38: Circular Buttons for DCS Drill Collar Slips

Slips	Slip Size Drill Collar Range [inches]	Part No.	Circular Buttons Weight		Qty Per Set
			[lbs]	[kg]	
DCS-S	3 - 4	2628.49	12	5.4	49
	4 - 4	2620.49	6	2.7	49
DCS-R	4 1/2 - 6	2628.63	16	7.3	63
	5 1/2 - 7	2620.63	8	3.6	63
	6.3/4 - 8.1/4	2630.88	11	5	88
	8 - 9 1/2	2630.96	12	5.4	96
DCS-L	8 1/2 - 10	2627.104	26	11.8	104
	9 1/4 - 11 1/4	2630.112	14	6.3	112
	11 - 12.3/4	2625.136	36	16.3	136
	12 - 14	2630.136	17	7.7	136

Casing slips

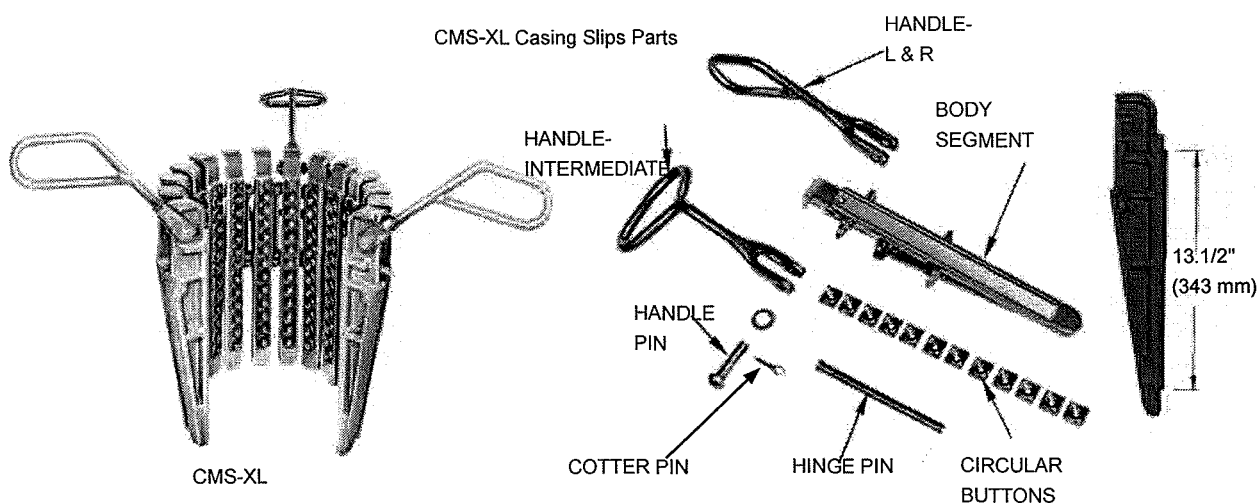


Figure TD- 19 CMS-XL Casing Slips

CMS-XL Casing Slip Grip Length

Table TD-39: CMS-XL Ordering Information

Description	Casing Size OD [inches]						
	6.5/8	7	7.5/8	8.5/8	9.5/8*	10.3/4*	11.3/4*
Part No. Slipcompletew/Circular Buttons	5315	5301	5303	5305	5307	5309	5311
Weight, completew/Circular Buttons, lbs (kg)	196 (88.9)	184 (83.5)	166 (75.3)	181 (82.1)	192(87.1)	209 (94.8)	260 (117.9)
Total number of Segments	12	12	12	13	14	15	17
Total number of Intermediate Segments	10	10	10	11	12	13	15
Total number of Hinge Pins	11	11	11	12	13	14	16

Description	Casing Size OD [inches]							
	13.3/8*	16	18*	18.5/8*	20*	24*	26*	30*
Part No. Slipcompletew/Circular Buttons	5313	5325	5335-I	5333	5329	5331	5346	5342
Weight, complete w/Circular Buttons, lbs(kg)	247(112)	308 (139.7)	367 (166.5)	367 (166.5)	383 (173.7)	443 (200.9)	486 (220.4)	546 (247.7)
Total number of Segments	18	21	25	25	26	30	33	37
Total number of Intermediate Segments	16	19	23	23	24	28	31	35
Total number of Hinge Pins	17	20	24	24	25	29	32	36

Notes: *Theses sizes are furnished with 4 handles. All Varco CMS-Extra Long Casing Slips have an API taper of 4 in./ft on the diameter.

Table TD-40: CMS-XL Parts List

Description	Part. No.	Weight	
		[lbs]	[kg]
Segment-Right End	5320	12	5.4
Segment-Left End	5321	12	5.4
Segment-Intermediate	5322	12	5.4
Hinge Pin with Cotter Key	2525	2/3	0.3
Handle Pin with Washer and Cotter Key	3769	1/2	0.2
Handle for Right and Left Hand Segment	3765	3.1/2	1.6
Handle for Intermediate Segment	3766	4	1.8
Retaining Screw with Lock Washer	3748	1/3	0.1

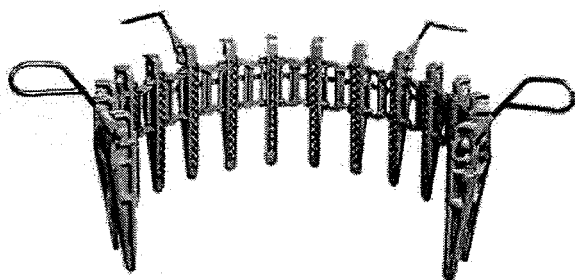


Figure TD-20: CP-S Conductor Pipe Slip

Table TD-41: CP-S Ordering Information

	Pipe size OD [inches]		
	24	26	30
Part No. Slip complete w/ circular buttons	5338	5344	5340
Weight Complete w/ circular buttons [lbs (kg)]	276 / 125	296 / 134	319 / 145
Total No. segments	13	14	16
Total No. Hinge Spacers	12	13	15

All CP-S Slips are furnished with 4 handles. All parts except Hinge Spacer Block, p/n 11944 are interchangeable with CMS-XL slips

Table TD-42: Circular buttons for CMS-XL & CP-S Slips

Type	Slips For casing size [inches]	Part No	Circular buttons		Qty. per set
			[lbs]	[kg]	
CMS-XL Extra Long	6.5/8	2628-144	45	20.5	144
	7	2619-144	36	16.3	144
	7.5/8	2630-144	18	8.2	144
	8.5/8	2630-156	19.1/2	8.9	156
	9.5/8	2630-180	21	9.5	168
	10.3/4	2630-180	22.1/2	10.2	180
	11.3/4	2627-204	51	23.1	204
	13.3/8	2630-216	27	12.3	216
	16	2631-252	31.1/2	14.3	252
	18	13868-300	59	26.8	300
	18.5/8	2626-300	56	25.4	300
	20	2631-312	39	17.7	312
	24	2631-360	45	20.5	360
	26	2631-396	49.1/2	22.5	396
	30	2631-444	55.1/2	25.2	444
CP-S	24	2631-156	20	9	156
	26	2631-168	21	9.5	168
	30	2631-192	24	10.9	192

INSPECTION & MAINTENANCE PROCEDURES

The owner and user together with the manufacturer should jointly develop and update inspection, maintenance, repair and remanufacture procedures consistent with equipment application, loading, work environment, usage and other operational conditions. These factors may change from time to time as a result of new technology, equipment history, product improvements, new maintenance techniques and changes in service conditions. Alternatively, NOV recommends using the Periodic inspection and maintenance categories and frequencies as mentioned in API RP8B.

NOV Recommends the following inspection intervals according to API RP8B

5.3.2.2 Category I

This category involves observing the equipment during operation for indications of inadequate performance. When in use, equipment shall be visually inspected on a daily basis for cracks, loose fits or connections, elongation of parts, and other signs of wear, corrosion or overloading. Any equipment found to show cracks, excessive wear, etc., shall be removed from service for further examination. The equipment shall be visually inspected by a person knowledgeable in that equipment and its function.

5.3.2.3 Category II

This is Category I inspection plus further inspection for corrosion, deformation, loose or missing components, deterioration, proper lubrication, visible external cracks, and adjustment.

5.3.2.4 Category III

This is Category II inspection plus further inspection, which should include NDT of critical areas and may involve some disassembly to access specific components and to identify wear that exceeds the manufacturer's allowable tolerances.

5.3.2.5 Category IV

This is Category III inspection plus further inspection for which the equipment is disassembled to the extent necessary to conduct NDT of all primary-load-carrying components as defined by manufacturer. Equipment shall be: disassembled in a suitably-equipped facility to the extent necessary to permit full inspection of all primary-load-carrying components and other components that are critical to the equipment; inspected for excessive wear, cracks, flaws and deformations. Corrections shall be made in accordance with the manufacturer's recommendations. Prior to Category III and Category IV inspections, all foreign material such as dirt, paint, grease, oil, scale, etc. shall be removed from the concerned parts by a suitable method (e.g. paint-stripping, steam-cleaning, grit-blasting).

Detailed instructions for inspection

Daily acc. to Cat I.

Visually inspect and repair when needed.

1. Check for worn and damaged parts
2. Check for loose and missing parts
3. Check for visible cracks
4. Check for yielding of parts
5. Check for other signs of wear and corrosion
6. Check good condition of all primary and secondary retention
7. Clean the toe area of the slip and check for overloading. Any signs of yielding in casting, loading and / or half moon shaped insert/button seat indicates to overloading.

Weekly acc. to Cat II.

Visually inspect and repair when needed.

1. Check for worn and damaged parts
 2. Check for loose and missing parts
 3. Check for cracks
 4. Check for yielding of parts
 5. Check for other signs of wear and corrosion or overloading
 6. Check for wear of the any pins
 7. Check that the product works flawlessly without interference
 8. Check state of lubrication
 9. Check good condition of all primary and secondary retention
- If ANY suspicion is risen about the condition of the tool, carry out a category IV-inspection

Semi annual acc. to Cat III.

Carry out the Cat II inspection. If ANY suspicion is risen about the condition of the tool, carry out a category IV-inspection

Annually acc. to Cat IV

Carry out the Cat III inspection + a Magnetic Particle Inspection of the toe area.

Detailed instructions for maintenance

Lubricate the tool regularly during usage and storage to prevent corrosion from attacking any part of the operating mechanism. Routine lubrication should be completed prior to use.

1. Grease any hinge pin.
2. Grease the back of the slips with EP1 or 2 grease or with Autol Top 2000

SAFETY CLAMPS



SAFETY CLAMPS PARTS

The MP&C Safety Clamp provides additional safety when handling flush joint pipe, liners and drill collars. The MP&C Clamp will act as an initiator to create additional clamping force through the slips whenever needed. The MP&C Clamp is fitted with grips for easy handling.

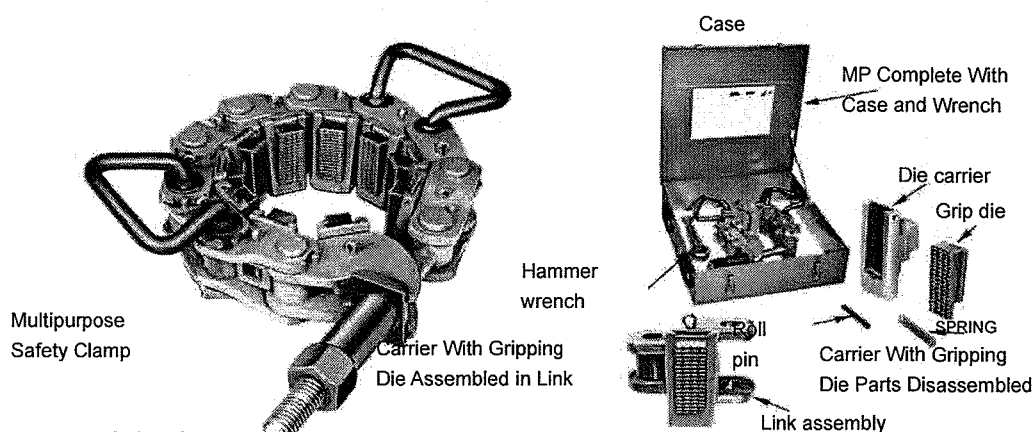


Figure TD-21: MP-Multipurpose Safety Clamp

Table TD-43: MP Ordering Information

		Quantity	Weight		
Range [inches]	Part No.	Links	Gripping Dies	[Lbs]	[kg]
MPS					
2.7/8-4.1/8	33030	7	8	83	37.6
4-5	33031	8	9	91	41.3
MPR					
4.1/2-5.5/8	33011	7	8	81	36.7
5.1/2-7	33012	8	9	89	40.4
6.3/4-8.1/2	33013	9	10	97	44
8-9.1/4	33014	10	11	105	47.6
9.1/4-10.1/2	33015	11	12	113	51.3
MPM					
10.1/2-11.1/2	33016	12	13	121	54.9
11.1/2-12.1/2	33017	13	14	129	58.6
12.1/2-13.5/8	33018	14	15	137	62.1
13.5/8-14.3/4	33019	15	16	145	65.8
14.3/4-15.7/8	33020	16	17	153	69.4
MPL					
15.7/8-17	33021	17	18	173	78.5
17-18.1/8	33022	18	19	181	82.1
18.1/8-19.3/8	33023	19	20	189	85.7
MP.XL					
19.3/8-20.3/8	33024	19	20	196	88.9
20.3/8-21.1/2	33025	20	21	204	92.5
21.1/2-22.5/8	33032	21	22	212	96.2
22.5/8-23.3/4	33033	22	23	220	99.8
23.3/4-24.7/8	33034	23	24	228	103.4
24.7/8-26	33035	24	25	236	107
26-27.1/8	33036	25	26	244	110.7
29.3/8-30.1/2	33039	28	29	336	152.4

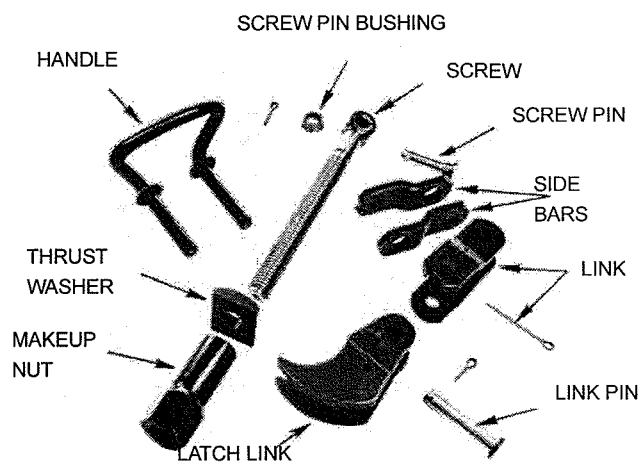


Figure TD-22: Safety Clamp Parts

Table TD-44: MP Ordering Information

Index No.	Part No.	Description	Qty per unit	Weight	
				[Lbs]	[kg]
1	3335	Link complete for MP.S only	AR	9	4
1	3319	Link complete for MP.R, MP.M, MP.L & MP.XL only	AR	8.75	6.9
2	3306	Link (w/ cotter pin for carrier)	1	4.25	2
3	3307	Pin for link (w/ cotter pin)	1	.75	.3
4	3325	Carrier ass'y, Die for MP.S only	1	6.25	2.8
4	3324	Carrier ass'y, Die for MP.R, MP.M, MP.L & MP.XL only	1	6	2.7
5	3333	Die, grip (w/ cotter pin) for MP.S only	1	1.25	.6
5	3310	Die, grip (w/ cotter pin) for MP.R, MP.M, MP.L & MP.XL only	1	1	.5
6	3309	Carrier, die	1	2.5	1.1
7	3311	Spring	1		
8	51604-18	Pin, roll	1		
9	51405-28	Pin, cotter	1		
10	3318	Bars, link side pr	1	2.5	1.1
11	3304	Link, latch for MP.S, MP.R, MP.M & MP.L	1	7	3.2
11	3321	Link, for MP.XL only	1	15	6.3
12	3308	Pin, Screw (w/ cotter pin)	1	.5	.2
13	3315	Bushing, screw pin	1	.5	.2
14	51405-10	Pin, Cotter (1 per link pin)	AR		
15	3302	Screw	1	5.5	2.5
16	2714	Washer, thrust	1	1	.5
17	3303	Nut, make up	1	3.5	1.6
18	3305	Handle, (2 req for MP.S, MP.R & MP.M; 4 req. for , MP.L & MP.XL)	AR	4.5	2
19	3316	Lug, hold down, (2 req for MP.S, MP.R & MP.M; 4 req. for , MP.L & MP.XL)	Opt	5.75	2.6
20	3317	Eye, Lifting (2 req for MP.S, MP.R & MP.M; 4 req. for , MP.L & MP.XL)	Opt	4.75	3.1
21	3320	Wrench	1	5	2.3
22	3331	Case for MP.S, MP.R, MP.M & MP.L	1	42	19.1
22	3334	Case for MP.XL	1	84	38.1

AR = As Required

Opt = Optional

USE OF MP&C SAFETY CLAMPS

Intended use of MP&C Safety Clamps

The intended use of MP&C Safety Clamps is to prevent flush tubulars (Casing or Drill Collars) from slipping through the hand slips. The Safety Clamp is fixed to the pipe per the installation instructions below. Should the casing or drill collar start to slip through the hand slips, the securely fastened safety clamp will land on top of the hand slips. The safety clamp will then push the slips further into the bowl and the inserts or buttons of the hand slip will grip the pipe more firmly and carry the string weight. The Safety Clamp is not designed to hold the string weight. It is a device that helps to set the hand slips better to ensure the string weight is carried in the slips.

MP&C Safety Clamps should only be used with manual hand slips.

Safety Clamps are not covered under API-ISO 1493:2003 7K ('API 7K'), nor under API-ISO 13535:2000 8C ('API 8C'). The MP&C Safety Clamp does not have a rating or safe working load.

In some old literature, the Safety Clamp is equipped with lifting ears to act as a single joint elevator. The MP&C Safety Clamp should NEVER be used as a single joint pick up elevator.



WARNING: Unintended Use of MP&C Safety Clamps

- WARNING: Safety Clamps are never to be used as hoisting equipment.
- WARNING: Safety Clamps are not intended to be used with any distance between the top of the slips and the Safety Clamp. Safety Clamps are not intended to take the impact, impact that may be imparted by pipe sliding in the slips if the Safety Clamp is mounted with a gap between it and the top of the slips. This would cause the Safety Clamp to slide with the pipe, resulting in the Safety Clamp impacting the top of the slips.
- WARNING: Safety Clamps should not interfere with the surrounding outside of the slip top area, e.g. guides or top covers.
- WARNING: Safety Clamps should not be used with Casing Elevator/Spider, FMS275, FMS375, PS21 or PS30. These tools have a top cover with top guide, which will prevent the Safety Clamp from landing on top of the slips. When using the Safety Clamp with these tools, the string weight will be imparted into the Safety Clamp leading to overload and possible failure of the Safety Clamp, when the pipe slides through the slips.

Effectiveness of MP&C Safety Clamps

The below listed factors are under the control & responsibility of the user to ensure the effectiveness of the Safety Clamp:

- The torque applied to tighten the clamp.
- Clamp placement around the tubular
- Distribution of clamp segments around the circumference
- Condition of the inserts
- Overall condition of the clamp segments
- Wear on parts
- Number of segments are used
- Pipe diameter
- Crushing capacity of the tubular

Safe Use of MP & C Safety Clamps

When using the safety clamps, proper installation must be used to ensure the safety clamp effectively contributes to the clamping force of the slips, should the pipe not be gripped adequately in the slips. This will best reduce the risk of pipe from sliding downward in the slips:

Always do the following as a minimum:

1. Ensure correct application by developing and providing operations & maintenance procedures.
2. Make sure the proper amount of segments are installed in the safety clamp to provide the optimum number of inserts in contact with the pipe. This depends on the size and type of pipe.
3. Always ensure the bottom surface of the safety clamp is setting on the slips with even distribution of contact around the bottom of the safety clamp.
4. Ensure the safety clamp is evenly tightened around the pipe. One procedure* to ensure this is to:
 - i. First tighten nut with the safety clamp hammer-wrench by hand.
 - ii. Tap on the top of the safety clamp at each hinge pin with the handle side of the hammer-wrench, ensuring safety clamp is level.
 - iii. Repeat steps i and ii until the safety clamp inserts are fully seated around the pipe and the hammer-wrench cannot be turned by hand.
 - iv. With the hammer-wrench firmly seated on the safety clamp nut, strike the hammer-wrench with a hammer until nut is securely tightened.
 - v. As a "Never-Use-Safety-Clamps-As-Hoisting-Equipment" last check, slowly lower the traveling blocks, and transfer the pipe weight to the slips; checking to ensure the pipe does not slide in the slips.
 - vi. Final check 1: Ensure all movement restriction dowels pins are clear of the locating shoulders on the connecting links.
 - vii. Final check 2: All gripping dies must be making good even contact with the pipe.

* See also image TD-23

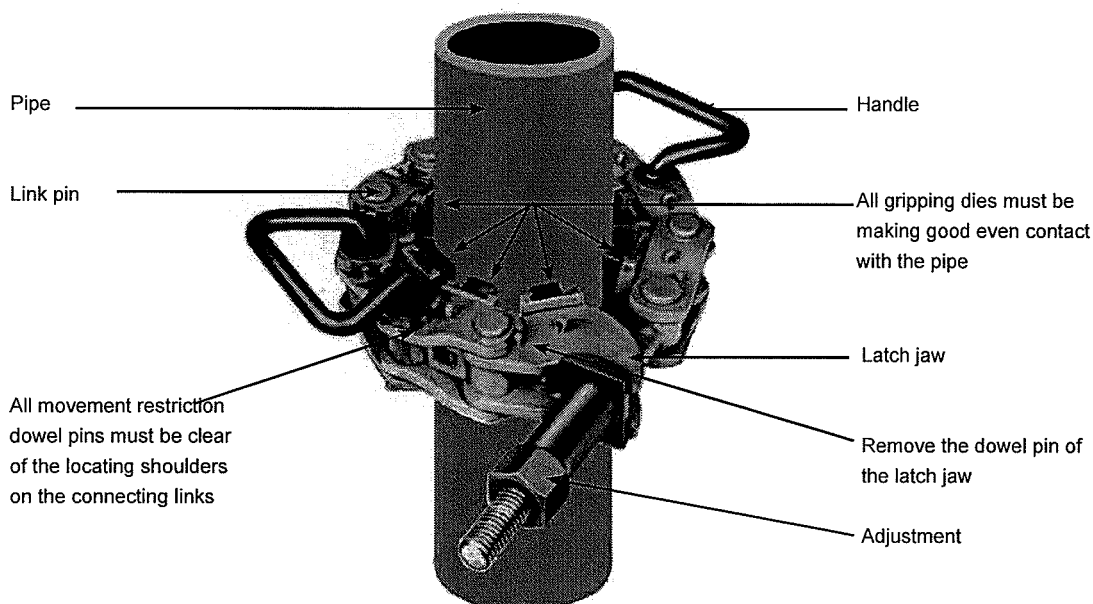


Figure TD-23: Multipurpose Safety Clamp

MAINTENANCE & INSPECTION

NOV recommends using the Inspection and Maintenance as outlined below as a minimum:

DETAILED INSTRUCTIONS FOR INSPECTION

Daily inspection

Visually inspect and repair when needed.

- Check for worn and damaged parts
- Check for loose and missing parts
- Check condition of parts
- Check that the product works flawlessly without interference
- Check good condition of all primary and secondary retention

DETAILED INSTRUCTIONS FOR MAINTENANCE

Lubricate the tool regularly during use and storage to prevent corrosion from attacking any part of the operating mechanism.

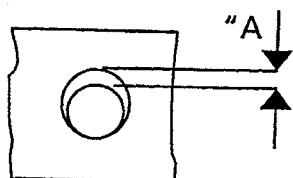
Routine lubrication should be completed prior to use.

1. Grease any hinge pins, screws, nuts, retainers and threads.
2. Ensure gripping dies (BACK SIDE ONLY) and carrier slots are well lubricated

Wear data

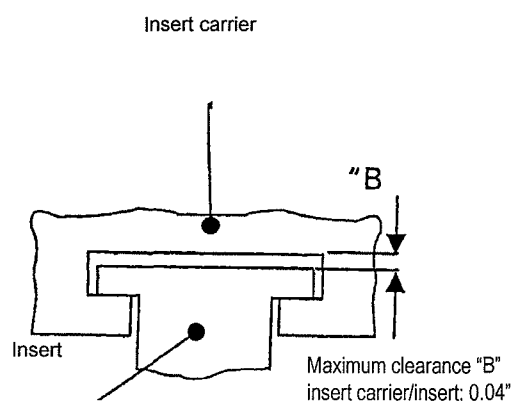
Link & latch part number 3307

Description	Wear [inches]
Total clearance "A"	0.04
Pin dia. New Max.	0.872
Bore dia. New Max.	0.895
Bore dia Worn max.	0.905



Handle part number 3305

Description	Wear [inches]
Total clearance "A"	0.04
Pin dia. New pin	0.872
Bore dia. New max.	0.895
Bore dia. Worn max.	0.905



SAFETY CLAMPS



LIFTING GEAR & SLINGS

LIFTING GEAR & SLINGS

Maintenance & inspection

The owner and user together with the manufacturer should jointly develop and update inspection, maintenance, repair and remanufacture procedures consistent with equipment application, loading, work environment, usage and other operational conditions. These factors may change from time to time as a result of new technology, equipment history, product improvements, new maintenance techniques and changes in service conditions. Alternatively, NOV recommends using the Periodic inspection and maintenance Categories and Frequencies as mentioned in API RP8B Table 1.

NOV Recommends the following inspection intervals according to API RP8B

5.3.2.2 Category I

This category involves observing the equipment during operation for indications of inadequate performance. When in use, equipment shall be visually inspected on a daily basis for cracks, loose fits or connections, elongation of parts, and other signs of wear, corrosion or overloading. Any equipment found to show cracks, excessive wear, etc., shall be removed from service for further examination. The equipment shall be visually inspected by a person knowledgeable in that equipment and its function.

5.3.2.3 Category II

This is Category I inspection plus further inspection for corrosion, deformation, loose or missing components, deterioration, proper lubrication, visible external cracks, and adjustment.

5.3.2.4 Category III

This is Category II inspection plus further inspection, which should include NOT of critical areas and may involve some disassembly to access specific components and to identify wear that exceeds the manufacturer's allowable tolerances.

5.3.2.5 Category IV

This is Category III inspection plus further inspection for which the equipment is disassembled to the extent necessary to conduct NDT of all primary-load-carrying components as defined by manufacturer. Equipment shall be: disassembled in a suitably-equipped facility to the extent necessary to permit full inspection of all primary-load-carrying components and other components that are critical to the equipment; inspected for excessive wear, cracks, flaws and deformations. Corrections shall be made in accordance with the manufacturer's recommendations. Prior to Category III and Category IV inspections, all foreign material such as dirt, paint, grease, oil, scale, etc. shall be removed from the concerned parts by a suitable method (e.g. paint-stripping, steam-cleaning, grit-blasting).

Detailed instructions for inspection

Weekly acc. to Cat II

Visually inspect and repair when needed.
Check for worn and damaged parts
Check for loose and missing parts
Check condition of shackles and / or hooks
Check condition of springs when present
Check for wear of the any pins
Check that the product works flawlessly without interference
Check state of lubrication
Check for any visible cracks
Check good condition of all primary and secondary retention
If ANY suspicion is risen about the condition of the tool, carry out a category IV-inspection

Semi annual acc. to Cat III

Carry out the Cat II inspection. If ANY suspicion is risen about the condition of the tool, carry out a category IV-inspection

Annually acc. to Cat IV

Carry out the Cat III inspection + a full Magnetic Particle Inspection of all primary load bearing load components:

Hooks

Chains

Cables

Beams

see Critical Area Drawings, when no Critical area drawing is available, the complete part is considered critical

Detailed instructions for maintenance

Lubricate the tool regularly during usage and storage to prevent corrosion from attacking any part of the operating mechanism.

Routine lubrication should be completed prior to use.

1. Grease any hinge, latch and lock pins.
2. Grease any grease nipples.
3. Grease any springs.
4. Grease retainers & fasteners.

LIFTING GEAR & SLINGS

The lifting gear and lifting slings needs to be treated according to ISO 13535:2000 8C "Lifting equipment".



WARNING: The lifting gear and slings in this chapter are loadtested and certified. Replacing of load carrying parts voids the certification. In order to obtain a new certification, pls. contact an authorized NOV repair facility.

QUICK REFERENCE LIFTING GEAR AND SLINGS

Tool	Part number	Type of lifting gear
MBH1250 + all Master Bushings	50001110*	4 Way Lifting Sling Chain Design
Casing Bushings	50001120	2 Way Lifting Sling Chain Design
MBH1250 + all Master Bushings	50001140**	4 Way Lifting Sling Cable Design
Casing Bushings	50001150	2 Way Lifting Sling Cable Design
Bowl #1,2,3 lifter	50001130	2 Way Lifting Sling Chain Design
Bowl #1,2,3 lifter	50001160	2 Way Lifting Sling Cable Design
MSPC Bowl lifter	1021	2 way Lifting Sling Chain Design
MPCH Master Bushing lifter	6699	4 way Lifting Sling Chain Design
***FMS275	59000300	2 way lifting sling
***FMS375	200982-1	4 way lifting sling
PS16	50004848	4 way lifting sling
***PS21	200982-1	4 way lifting sling
***PS21 slips	50004551	2 way lifting sling
***PS21 insert carriers	50004600-1	1 way lifting sling Pogo Stick
***PS21 hand slip bowl	50004550-21	Hand slip bowl removal tool
***PS30	200982-1	4 way lifting sling
***PS30 slips	50004551	2 way lifting sling
***PS30 insert carriers	50004600-1	1 way lifting sling Pogo Stick
***PS30 hand slip bowl	50004550-30	Hand slip bowl removal tool
***SJL-SPL	34568-5	Swivel suspension

* 50001110 also as alternative for 50001120

** 50001140 also as alternative for 50001150

*** See dedicated User Manual for details

LIFTING SLINGS FOR MBH1250 MASTER BUSHINGS & BOWLS & PS16

Suitable for the MBH1250 Master Bushing, Casing Bushings and the MBH-bowls + PS16 Power Slip. Allowed for overhead lifting purposes.

Main part numbers

Name	Part number	CE	DNV	Suitable for
4 Way Lifting Sling Chain Design	50001110	Yes	Yes	MBH1250 + all Master Bushings
2 Way Lifting Sling Chain Design	50001120	Yes	Yes	Casing Bushings
4 Way Lifting Sling Cable Design	50001140	Yes	Yes	MBH1250 + all Master Bushings
2 Way Lifting Sling Cable Design	50001150	Yes	Yes	Casing Bushings
4 Way Lifting Sling Chain Design	50004848	Yes	Yes	PS16 Power Slip

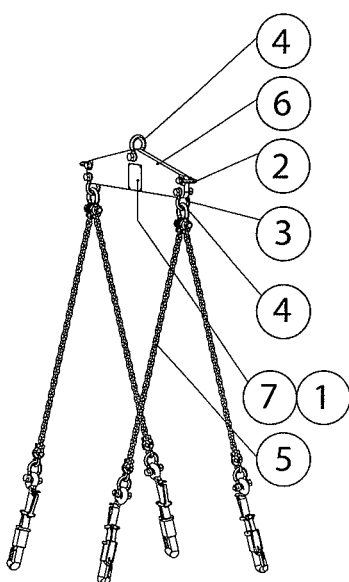


Figure 129: PN 50001110

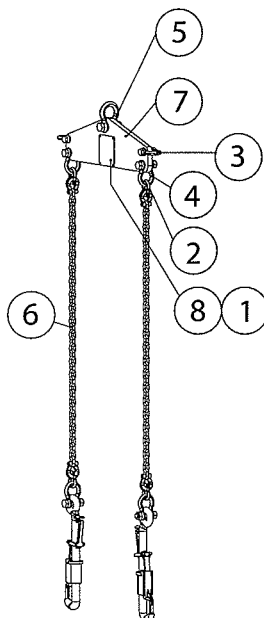


Figure 130: PN 50001120

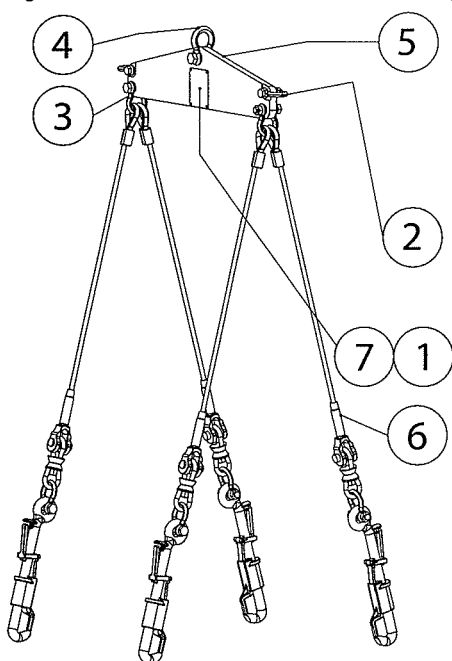


Figure 131: PN 50001140

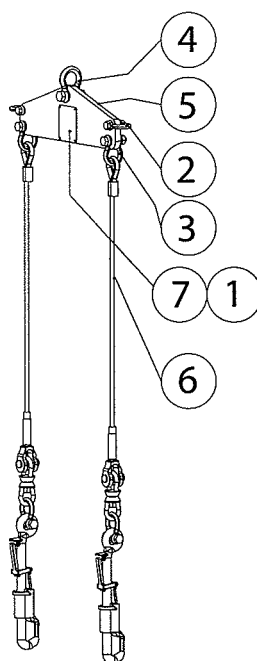


Figure 132: PN 50001150

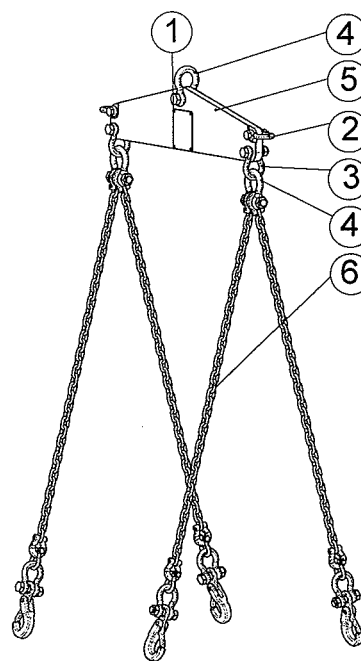


Figure 132-A: PN 50004848

Main part numbers

50001110			
Item No.	Part number	Part Description	Qty.
1	53301-10-8	Screw, drive- type U	4
2	979459-325	Shackle SWL 3.25 M.tonnes + DNV	2
3	979459-475	Shackle SWL 4.75 M.tonnes + DNV	2
4	979459-650	Shackle SWL 6.50 M.tonnes + DNV	3
5	50001118	Leg assembly for lifting sling	4
6	50001119	Spreader bar 4-way lifting sling	1
7	50001122	ID TAD 4-way lifting sling	1
50001120			
Item No.	Part number	Part Description	
1	53301-10-8	Screw, drive- type U	4
2	979459-200	Shackle SWL 2.00 M.tonnes + DNV	2
3	979459-325	Shackle SWL 3.25 M.tonnes + DNV	2
4	979459-475	Shackle SWL 4.75 M.tonnes + DNV	2
5	979459-650	Shackle SWL 6.50 M.tonnes + DNV	1
6	50001118	Leg assembly for lifting sling	2
7	50001121	Spreader bar 2-way lifting sling	1
8	50001123	ID TAG 2-way lifting sling	1
50001140			
Item No.	Part number	Part Description	
1	53301-10-8	Screw, drive- type U	4
2	979459-325	Shackle SWL 3.25 M.tonnes + DNV	2
3	979459-475	Shackle SWL 4.75 M.tonnes + DNV	2
4	979459-650	Shackle SWL 6.50 M.tonnes + DNV	11
5	50001119	Spreader bar 4-way lifting sling	1
6	50001142	Leg ass'y lifting sling cable design	4
7	50001143	ID TAG 4-way lifting sling	1
50001145			
Item No.	Part number	Part Description	
1	53301-10-8	Screw, drive- type U	4
2	979459-325	Shackle SWL 3.25 M.tonnes + DNV	2
3	979459-475	Shackle SWL 4.75 M.tonnes + DNV	2
4	979459-650	Shackle SWL 6.50 M.tonnes + DNV	1
5	50001121	Spreader bar 2-way lifting sling	1
6	50001142	Leg ass'y lifting sling cable design	2
7	50001144	ID TAG 2-way lifting sling	1
50004848			
Item No.	Part number	Part Description	
1	53301-10-8	Screw, drive- type U	4
2	979459-325	Shackle SWL 3.25 M.tonnes + DNV	2
3	979459-475	Shackle SWL 4.75 M.tonnes + DNV	2
4	979459-650	Shackle SWL 6.50 M.tonnes + DNV	1
5	50001119	Spreader bar 4-way lifting sling	1
6	50004848-1	Leg ass'y for lifting sling	2
7	50004848-2	ID TAG 4-way lifting sling	1

LIFTING SLINGS FOR MP & MS MASTER BUSHINGS & BOWLS

Suitable for the MPCH, MSPC & MSP Master Bushing & Bowls. Not allowed for overhead lifting purposes.

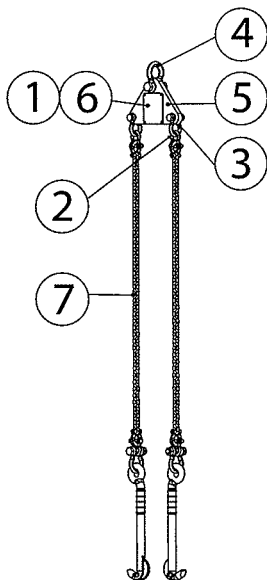


Figure 133: PN 50001130

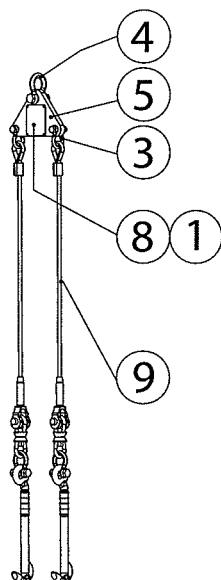


Figure 134: PN 50001160

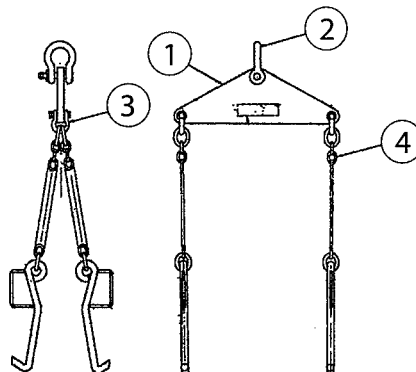


Figure 135: PN 6699

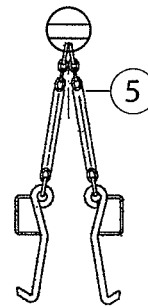


Figure 135a: PN 1021

Main part numbers

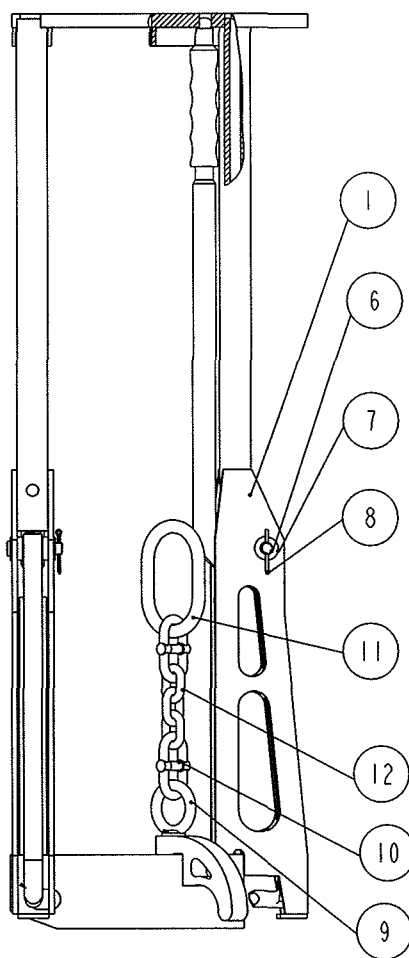
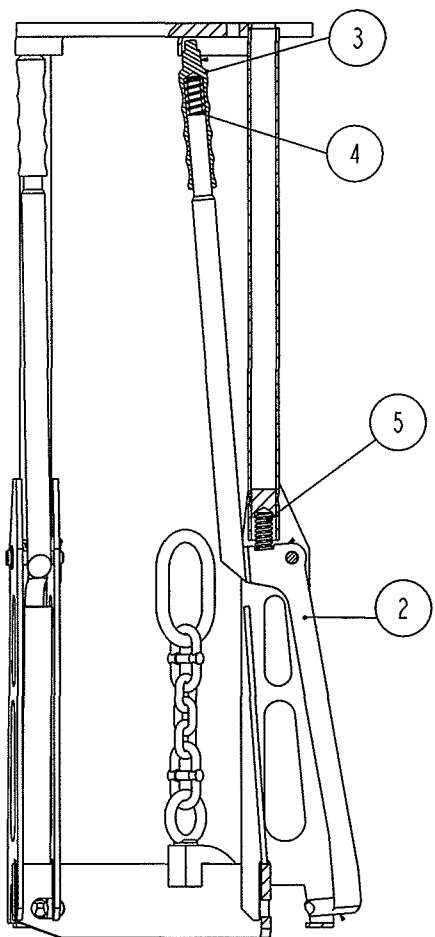
Name	Part number	CE	DnV	Suitable as
2 Way Lifting Sling Chain Design	50001130	Yes	Yes	Bowl lifter
2 Way Lifting Sling Cable Design	50001160	Yes	Yes	Bowl lifter
2 way Lifting Sling Chain Design	1021	No	No	Bowl lifter
4 way Lifting Sling Chain Design	6699	No	No	Master Bushing lifter

Item No	Part number	Part Description	50001130 Qty	50001160 Qty
1	53301-10-8	Screw, drive- type U	4	4
2	979459-200	Shackle SWL 2.00 M.tonnes + DNV	4	-
3	979459-325	Shackle SWL 3.25 M.tonnes + DNV	2	2
4	979459-650	Shackle SWL 6.50 M.tonnes + DNV	1	1
5	50001127	2-way bowl lifter spreader bar	1	1
6	50001128	ID TAG 2-way bowl lifter	1	-
7	50001126	Leg assembly for bowl lifter	2	-
8	50001145	ID TAG 2-way bowl lifter	-	1
9	50001161	Cable ass'y for lifting sling	-	2

	Part number	Part Description	6699 Qty	1021 Qty
1	5415	Beam, lifting	1	-
2	5417	Shackle, anchor safety type	2	-
3	979459-650	Shackle, anchor screw pin	1	-
4	5423	Chain and hook weldment	4	-
5	1021	Assembly	-	1

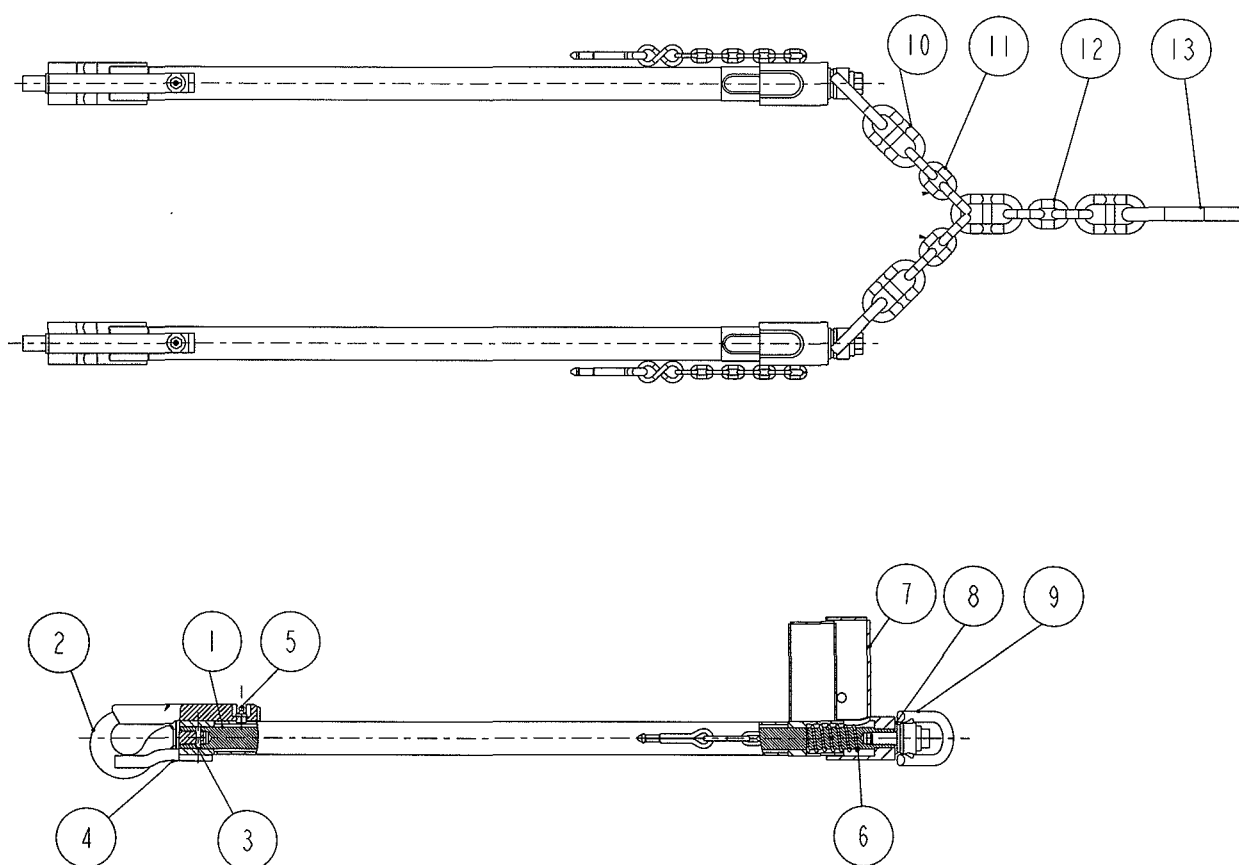
Hand slip bowl removal tool PS21 / PS30 (50004550-21/50004550-30)

Item No	Part number	Part Description	Qty
1	50004550-32	Frame bowl lifting tool PS30	1
2	50004550-23	Hook bowl lifting tool	2
3	50004550-25	Lock pin	2
4	200346	Spring pipe sensor D-12730	2
5	979386-5	Compression spring	2
6	56408-18-C	Pin, clevis 2.1/4"	2
7	50808-N-C	Washer flat	4
8	51402-12	Cotter pin 0.125 x 1.5	2
9	57000-10-14	Eye-bolt shouldered 5/8" UNC 1/3/4" long	1
10	59000062-5	Connecting link, 5/16"	2
11	59000063-8	1/2" master link	1
12	59000064-5-40	Chain, 5/16", 40 shackles	1



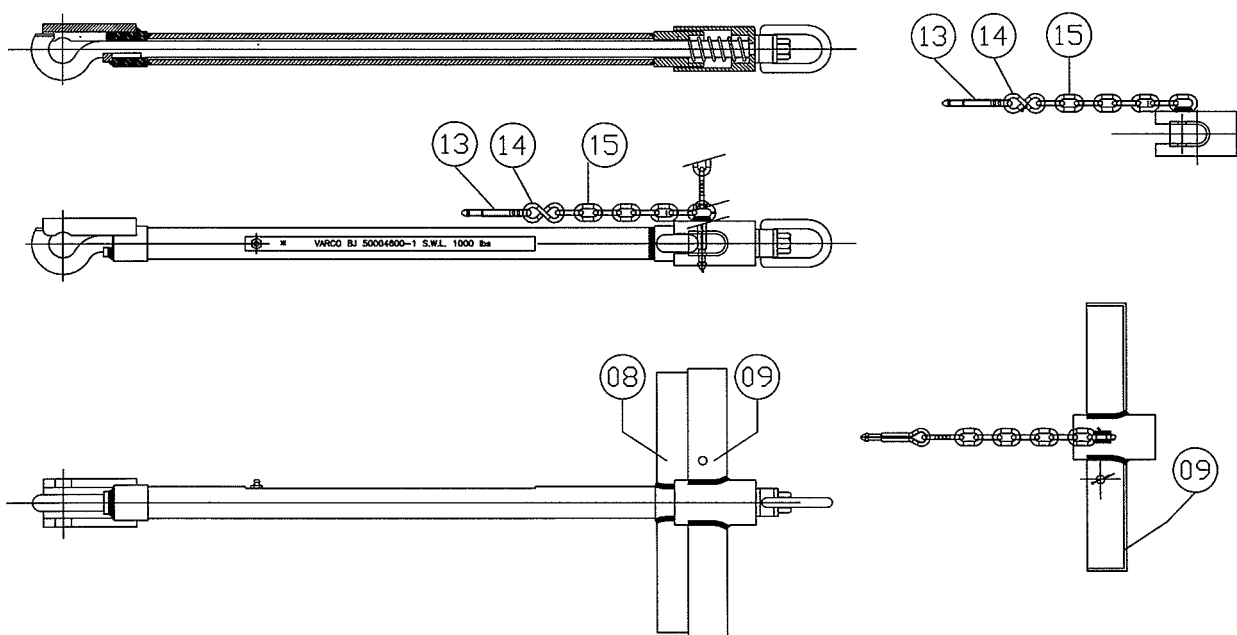
Lifting tool PS21 / PS30 (50004551)

Item No	Part number	Part Description	Qty
1	50004551-1	Shaft	2
2	50004551-2	Hook	2
3	51503-7	Pin, grooved taper	2
4	50004551-3	Housing	2
5	53201	Grease nipple	2
6	980474	Compression spring	2
7	50004551-4	Handle	2
8	50808-R-C	Washer, 1/2" flat regular	2
9	980473-10	Hoist swivel ring	2
10	59000062-5	Connecting link	4
11	59000064-5-8	Chain 5/16" 8 shackles	2
12	59000064-5-40	Chain 5/16" 40 shackles	1
13	59000063-8	Master link 1/2"	1



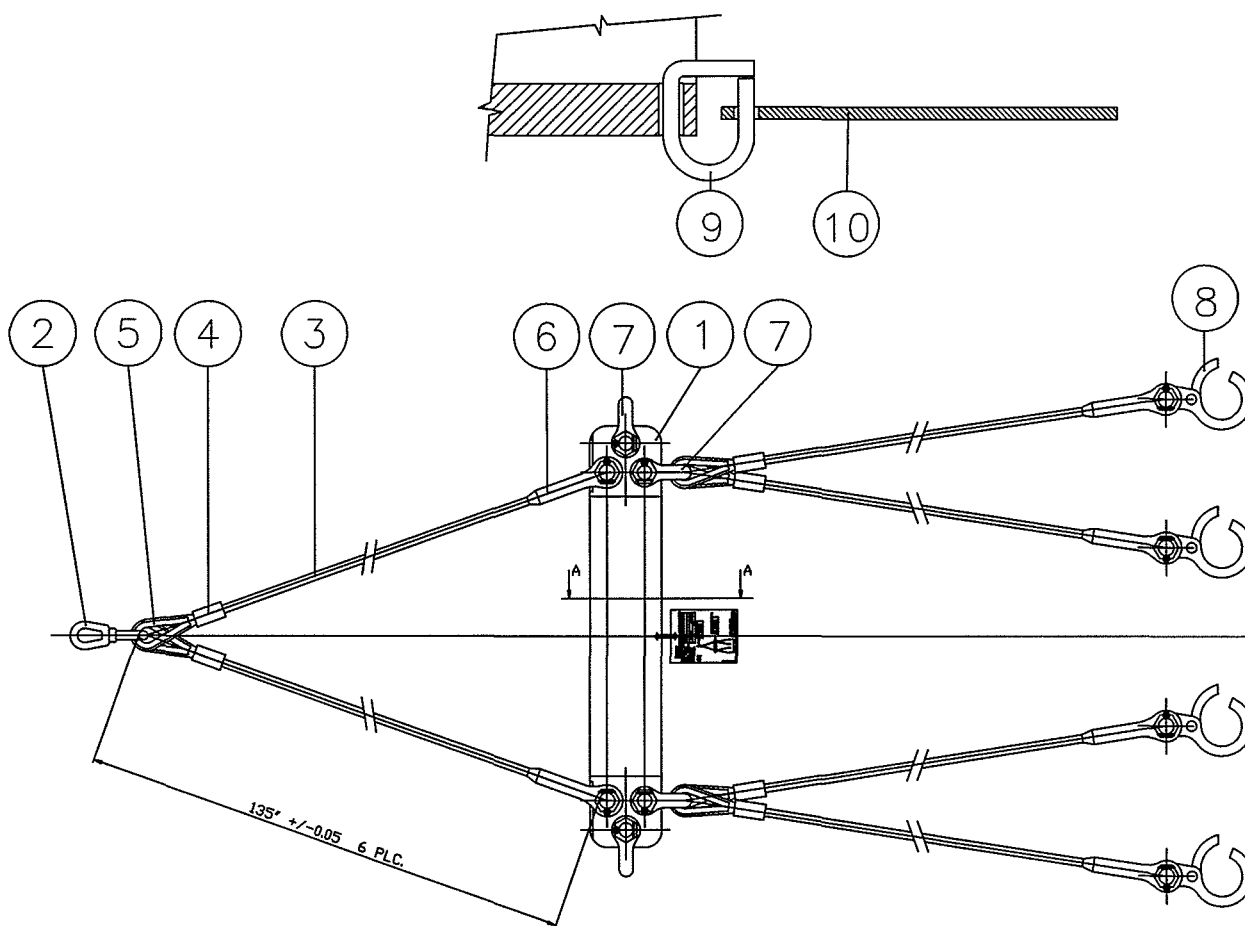
Pogo stick - PS21 / PS30 (p/n 50004600-1)

Item No	Part number	Part Description	Qty
08	50004600-8	Lower handle bar	2
09	50004600-9	Upper handle bar	2
13	50004950	Latch retainer / cotter pin	1 or 2
14	948051-2	S-hook	1 or 2
15	59001008-4	Chain, straight link, 8 links	1 or 2



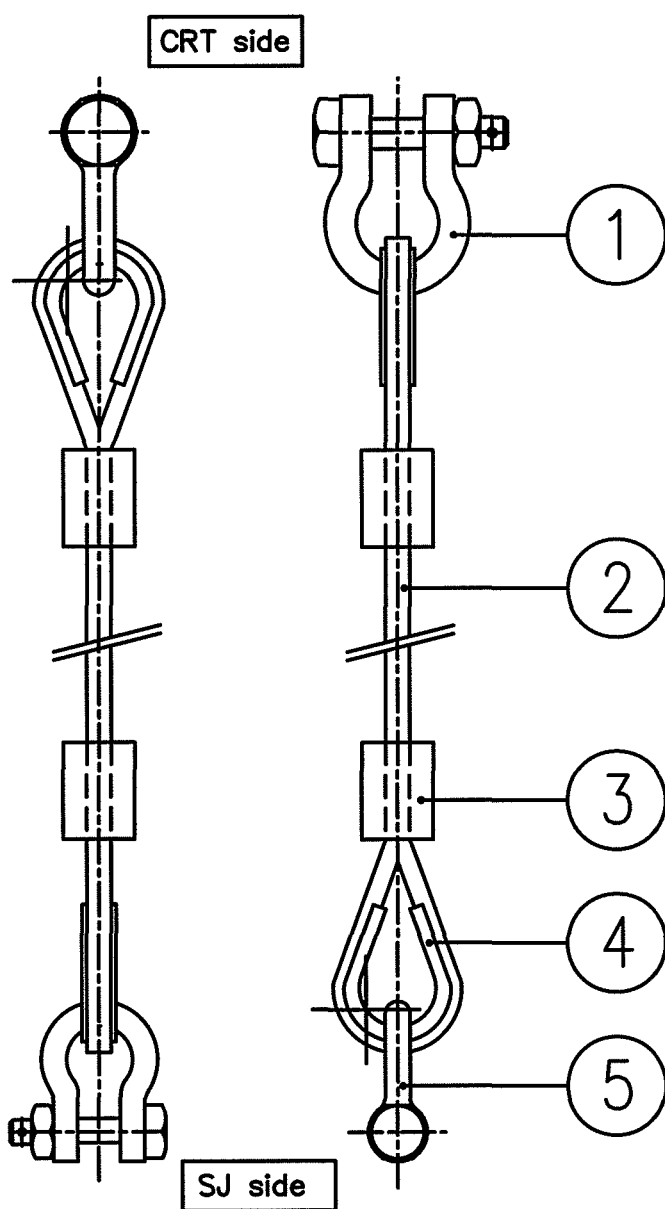
Lifting sling - PS21 / PS30 (200982-1)

Item No	Part number	Part Description	Qty
1	200982	Spreader bar	1
2	979456-8	Swivel	1
3	979436-16	Cable	6
4	979435-16	Duplex non tapered sleeve	6
5	939315-16	Thimble	6
6	200982-2	Open swage socket	6
7	979459-8	Shackle	4
8	980278	Hoist hook with latch	4
9	203239	Pull loop/link	1
10	200982-3	Lifting sling ID-tag	1



Safety sling for CRT500 (50008021)

Item No	Part number	Part Description	Qty
1	979459-650	Shackle 6.5 Ton (metric)	2
2	979460-18	Cable	2
3	979458-18	Sleeve	4
4	979457-18	Thimble	4
5	979459-475	Shackle 4.75 Ton (metric)	2

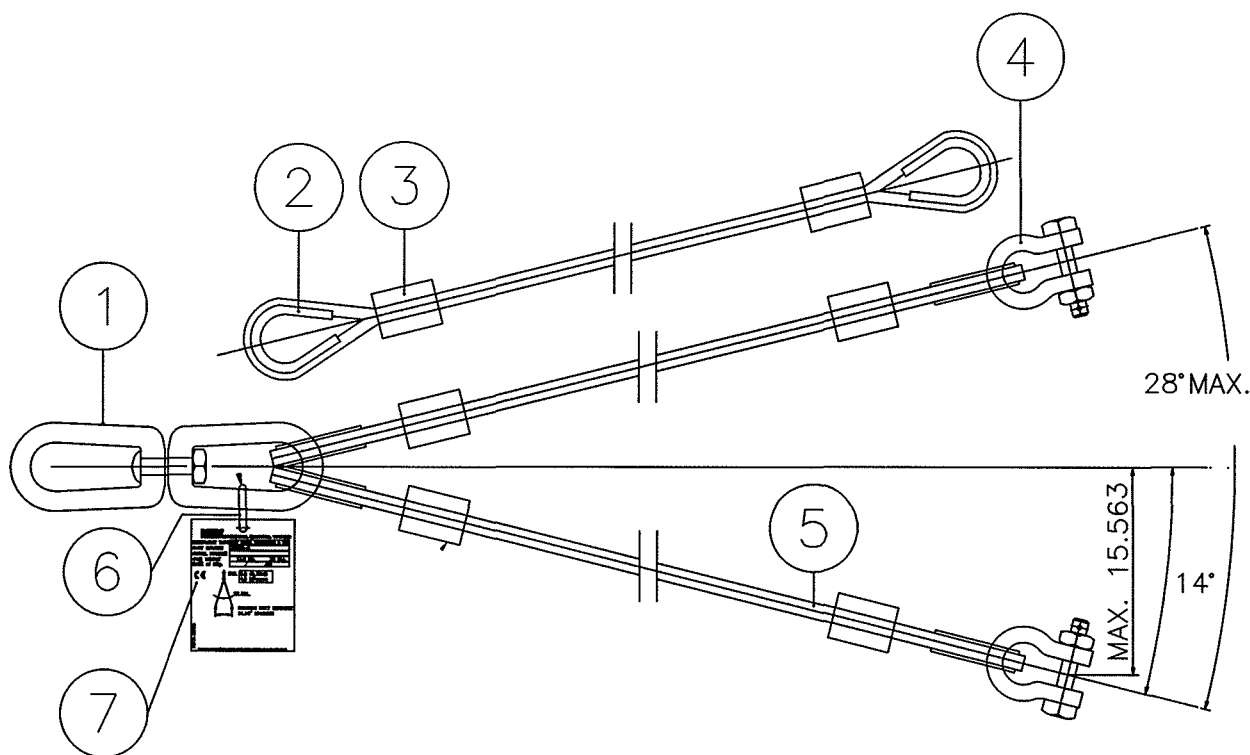


Swivel suspension SJL-SPL assembly (34568-5)

Item No	Part Number	Part Description
1	979456-56	Regular swivel Min WWL 6.26 tons
2	979457-18	Thimble
3	979458-18	Swage sleeve
4	979459-475	Shackle bolt type 3/4" 4.75 ton
5	979460-18	Cable 6 x 25 fw iwrc (179 KN)
6	50001125	Weld ring for id tag 50001124
7	50001124	ID tag 2-way lifting sling 34568-5

Suitable for assemblies

200029	200030	200025	33044
200014	36174	70505	33043
200013	36173	70504	33042
200012	36385	70503	33041
200011	70252	70502	33040
200010	36172	70501	33039
200009	36171	70500	
200008	53615	70499	





ADAPTER RINGS



ADAPTER RINGS



ADAPTER RINGS

Adapter rings, both solid and hinged to be used for creating a smaller hole for accommodating smaller (power) slips. Adapter rings are considered to be ISO 14693:2003 7K devices.



Maintenance & inspection

The owner and user together with the manufacturer should jointly develop and update inspection, maintenance, repair and remanufacture procedures consistent with equipment application, loading, work environment, usage and other operational conditions. These factors may change from time to time as a result of new technology, equipment history, product improvements, new maintenance techniques and changes in service conditions. Alternatively, NOV recommends using the Periodic inspection and maintenance categories and frequencies as mentioned in API RP8B Table 1.

NOV Recommends the following inspection intervals according to API RP8B

5.3.2.2 Category I

This category involves observing the equipment during operation for indications of inadequate performance. When in use, equipment shall be visually inspected on a daily basis for cracks, loose fits or connections, elongation of parts, and other signs of wear, corrosion or overloading. Any equipment found to show cracks, excessive wear, etc., shall be removed from service for further examination. The equipment shall be visually inspected by a person knowledgeable in that equipment and its function.

5.3.2.3 Category II

This is Category I inspection plus further inspection for corrosion, deformation, loose or missing components, deterioration, proper lubrication, visible external cracks, and adjustment.

5.3.2.4 Category III

This is Category II inspection plus further inspection, which should include NDT of critical areas and may involve some disassembly to access specific components and to identify wear that exceeds the manufacturer's allowable tolerances.

5.3.2.5 Category IV

This is Category III inspection plus further inspection for which the equipment is disassembled to the extent necessary to conduct NDT of all primary-load-carrying components as defined by manufacturer. Equipment shall be: disassembled in a suitably-equipped facility to the extent necessary to permit full inspection of all primary-load-carrying components and other components that are critical to the equipment; inspected for excessive wear, cracks, flaws and deformations. Corrections shall be made in accordance with the manufacturer's recommendations. Prior to Category III and Category IV inspections, all foreign material such as dirt, paint, grease, oil, scale, etc. shall be removed from the concerned parts by a suitable method (e.g. paint-stripping, steam-cleaning, grit-blasting).

Detailed instructions for inspection

Weekly acc. to Cat II

1. Visually inspect and repair when needed.
 2. Check for worn and damaged parts
 3. Check for loose and missing parts
 4. Check condition of shackles and / or hooks
 5. Check condition of springs when present
 6. Check for wear of the any pins
 7. Check that the product works flawlessly without interference
 8. Check state of lubrication
 9. Check for any visible cracks
 10. Check good condition of all primary and secondary retention
- If ANY suspicion is risen about the condition of the tool, carry out a category IV-inspection

Semi annual acc. to Cat III

Carry out the Cat II inspection. If ANY suspicion is risen about the condition of the tool, carry out a category IV-inspection

Annually acc. to Cat IV

Carry out the Cat III inspection + a full Magnetic Particle Inspection of all primary load bearing load components:

1. Hooks
2. Chains
3. Cables
4. Beams

see Critical Area Drawings, when no Critical area drawing is available, the complete part is considered critical

Detailed instructions for Maintenance

Lubricate the tool regularly during usage and storage to prevent corrosion from attacking any part of the operating mechanism. Routine lubrication should be completed prior to use.

1. Grease any hinge, latch and lock pins.
2. Grease any grease nipples.
3. Grease any springs.
4. Grease retainers & fasteners.

Instructions for Use



WARNING: Do not use the adapter ring to pull the tool sitting in the adapter ring from the rotary.

Assembly numbers

Adapter-model from - to	Part number	Solid or hinged
NOV 75.1/2" to NOV 60.1/2"	50005448-1	Solid
NOV 75.1/2" to National 49.1/2"	50005450-1	Solid
NOV 75.1/2" to National 60.1/2"	50005449-1	Solid
NOV 60.1/2" to National 49.1/2"	50004702-1	Solid
NOV 60.1/2" to National 49.1/2"	50004703-1	Solid
NOV 60.1/2" to National 49.1/2"	50004704-1	Hinged
National 49.1/2" to National 37.1/2"	50004995	Hinged
National 49.1/2" to National 37.1/2"	50004996	Hinged
National 49.1/2" to Emsco 37.1/2"	250360	Hinged
Oilwell 37.1/2" to National 37.1/2"	200990-11	Hinged
Emsco 37.1/2" to National 37.1/2"	200991-11	Hinged
National 37.1/2" to National 37.1/2"	200995-11	Hinged
Ideco 37.1/2" to National 37.1/2"	201430-1	Hinged
Emsco 37.1/2" to Emsco 37.1/2"	202244-1	Hinged
Emsco 37.1/2" to API -standard 27.1/2"	50004994	Hinged
National 37.1/2" to API-standard 27.1/2"	50004998	Hinged
Oilwell 37.1/2" to API-standard 27.1/2"	50004999	Hinged

Parts

Item No.	Part Description	50005448-1**		50005450-1		50005449-1	
		Component Part	Qty	Component Part	Qty	Component Part	Qty
1	Eccentric pin MSS-MSPC-MPCH	1014	2	1014	2	1014	2
2	Screw, cap-Hex. HD (UNC-2A)	50012-28-C8D	4	50012-28-C8D	4	50012-28-C8D	4
3	Washer, lock-regular 3/4"	50912-C	4	50912-C	4	50912-C	4
4	Solid adapter machining*	50005448-M	1	50005450-M	1	50005449-M	1
5	Pin, grooved taper	51506-26	2	51506-26	2	51506-26	2
6	Adapter drive lug	202669-2	2	202669-2	2	202669-2	2
7	Lock for adapter	202673	2	202673	2	202673	2
8	Hoist swivel ring ADB, modified	980473-2	3	980473-2	3	980473-2	3

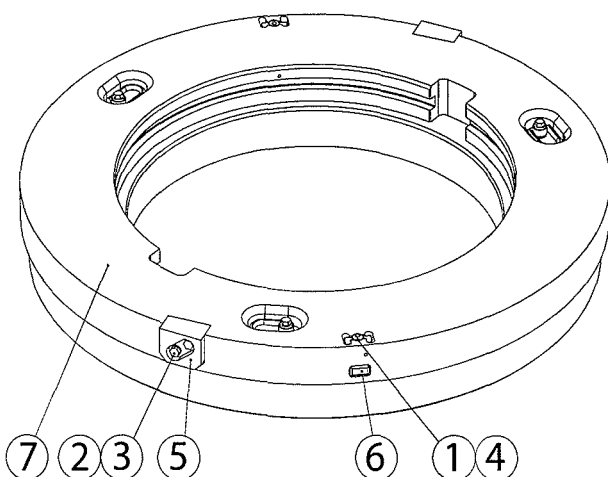
Part Description	50004995		50004996		250360**	
	Component Part	Qty	Component Part	Qty	Component Part	Qty
1	Eccentric pin MSS-MSPC-MPCH	1014	1014	2	1014	2
2	Pin, grooved taper	51506-26	51506-26	2	51506-26	2
3	Lock for Varco/nat. table	202211-C	202211-C	2	202211-C	2
4	Adapter 49.5 to 37.5	50004995-M	50004995-M	1	50004996-M	1
5	Adapter 49.5 to 37.5	n/a	50004996-M	1	50004996-M	1
6	Removable hinge pin adap.bush.	50004997	50004997	2	50004997	2

Part Description	200990-11		200991-11		200995-11	
	Component Part	Qty	Component Part	Qty	Component Part	Qty
1	Adapter plate	200990-10M	200991-10M	2	200995-10M	2
2	Hinge pin	201398	201398	1	201398	1
3	Hinge pin	201399	201399	1	201399	1
4	Pin, grooved taper	51508-26	51508-26	1	51508-26	1
5	Fitting,grease,straight	53201	53201	1	53201	1
6	Safe.lock pin w/ring FMS /HK20000	912374-1	912374-1	1	912374-1	1
7	S HOOK ACCO#63-15/16 I.LG	948038-19	948038-19	1	948038-19	1
8	Chain	948042-10	948042-10	1	948042-10	1
9	Hoist swivel ring ADB, modified	980473-1	980473-1	2	980473-1	2

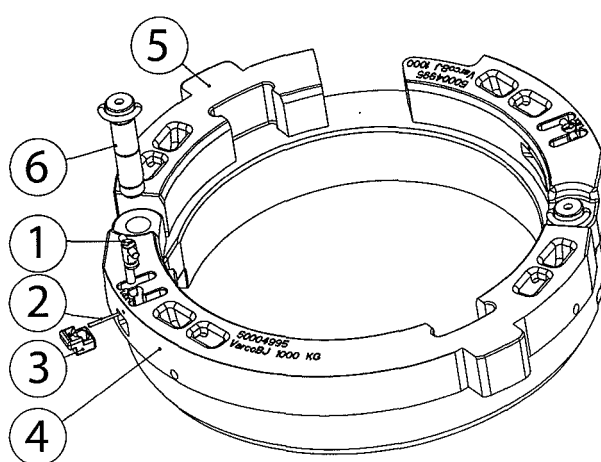
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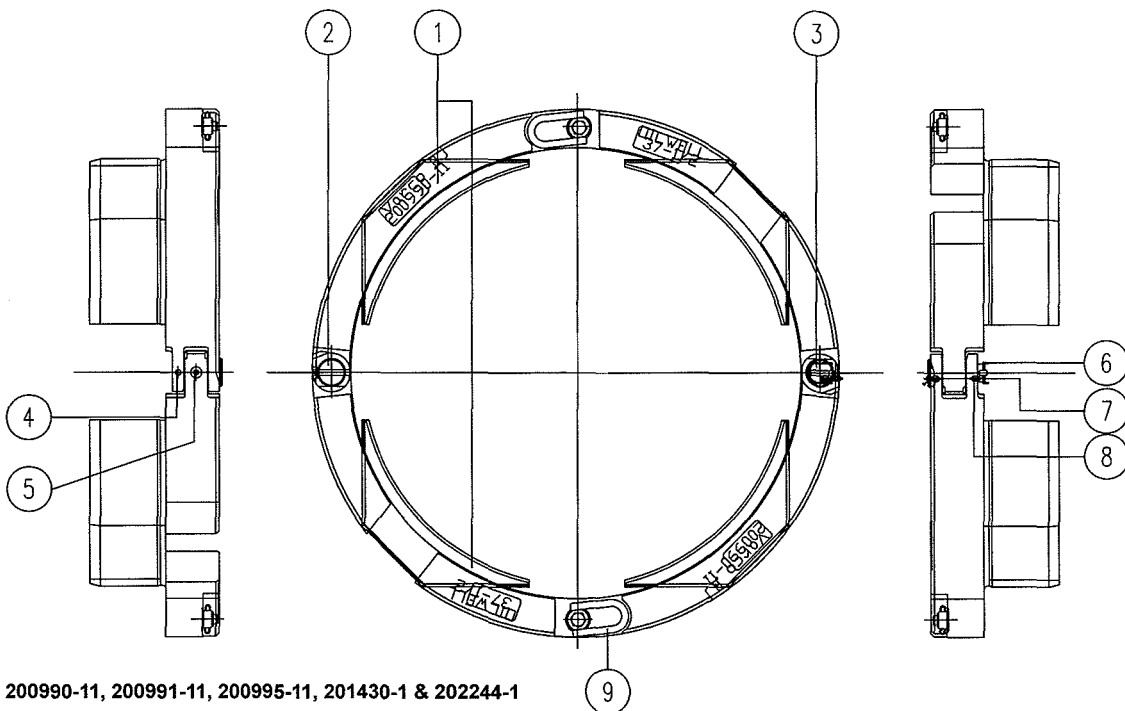
Item NO.	Part Description	201430-1	202244-1
		Component Part Qty	Component Part Qty
1	Adapter plate	201430-W 2	202244-W 1
2	Hinge pin	201398 1	979941-10 2
3	Hinge pin	201399 1	201398 1
4	Pin, grooved taper	51508-26 1	201399 1
5	Fitting,grease,straight	53201 1	53201 1
6	Safe.lock pin w/ring FMS /HK20000	912374-1 1	51508-30 1
7	S HOOK ACCO#63-15/16 I.LG	948038-19 1	948038-19 1
8	Chain	948042-10 1	948042-10 1
9	Hoist swivel ring ADB, modified	980473-1 2	980473-1 2



50005448-1, 50005450-1 & 50005449-1



50004995, 50004996 & 250360

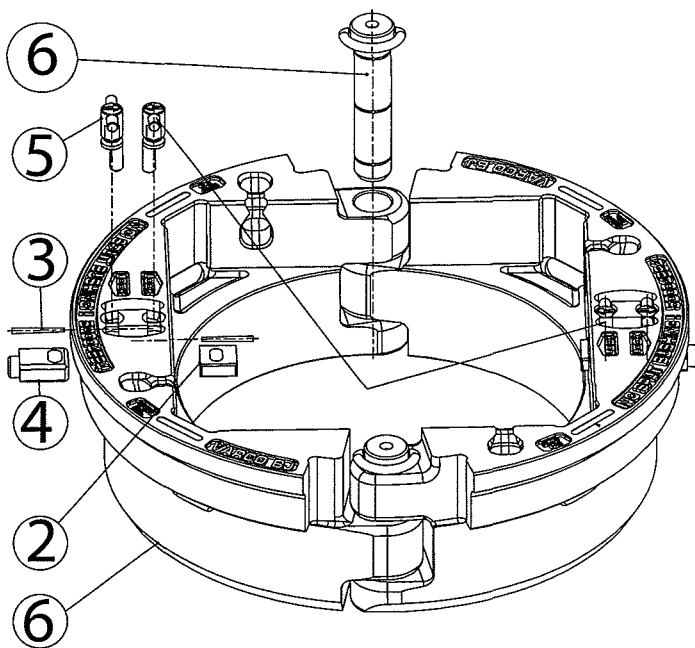


200990-11, 200991-11, 200995-11, 201430-1 & 202244-1

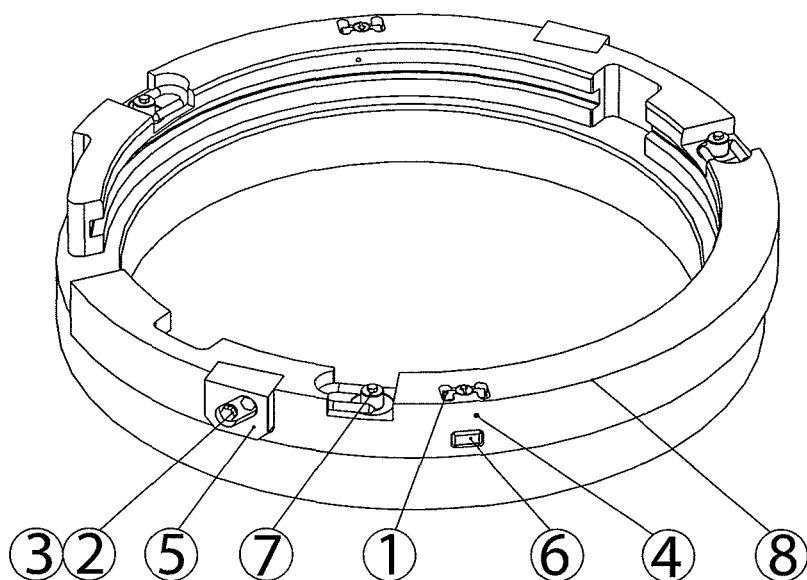
Parts

Part Description	Item No.	50004994	Component Part	Qty	Item No.	50004998	Component Part	Qty	Item No.	50004999**	Component Part	Qty
Eccentric pin MSS-MSPC-MPCH	1	1014	4	1	1014	4	1	1014	4	1	1014	4
Lock MSS-MSPC-MPCH 20.1/2" to 27.1/2"	2	1016	2	2	1016	2	2	1016	2	2	1016	2
Pin, grooved taper	3	51506-26	4	3	51506-26	4	3	51506-26	4	3	51506-26	4
Lock for table	4	202212	2	4	202211	2	4	202211	2	4	202211	2
Hinged adapter bushing	5	50004994-C	2	5	50004998-C	2	5	50004998-C	2	5	50004999-C	2
Removable hinge pin adap.bush.	6	50004997	2	6	50004997	2	6	50004997	2	6	50004997	2
Part Description		50004702-1	Component Part	Qty		50004703-1	Component Part	Qty		50004704-1	Component Part	Qty
Eccentric pin MSS-MSPC-MPCH	1	1014	2	1	1014	2	1	1014	2	1	1014	2
Screw, cap-Hex. HD (UNC-2A)	2	50012-28-C8D	4	2	50012-28-C8D	4	2	50012-28-C8D	4	2	50012-28-C8D	4
Washer, lock-regular 3/4"	3	50912-C	4	3	50912-C	4	3	50912-C	4	3	50912-C	4
Pin, grooved taper	4	51506-26	2	4	51506-26	2	4	51506-26	2	4	51506-26	2
PS30 w/ elevator d-ring center slip		n/a			n/a			n/a		5	202374	4
Adapter drive lug	5	202669-2	2	5	202669-2	2	6	202669-2	2	6	202669-2	2
Lock for adapter	6	202673	2	6	202673	2	7	202673	2	7	202673	2
Hoist swivel ring ADB, modified	7	980473-1	3	7	980473-1	3		n/a			n/a	
Lifting pin RST 49.5->37.5		n/a			n/a			n/a		8	250307	4
Solid adapter machining*	8	50004702-M	1	8	50004702-M	1	9	50004704-M	1	9	50004704-M	1
Hinge pin ass'y., adapter		n/a			n/a			n/a		10	50004705-1	2

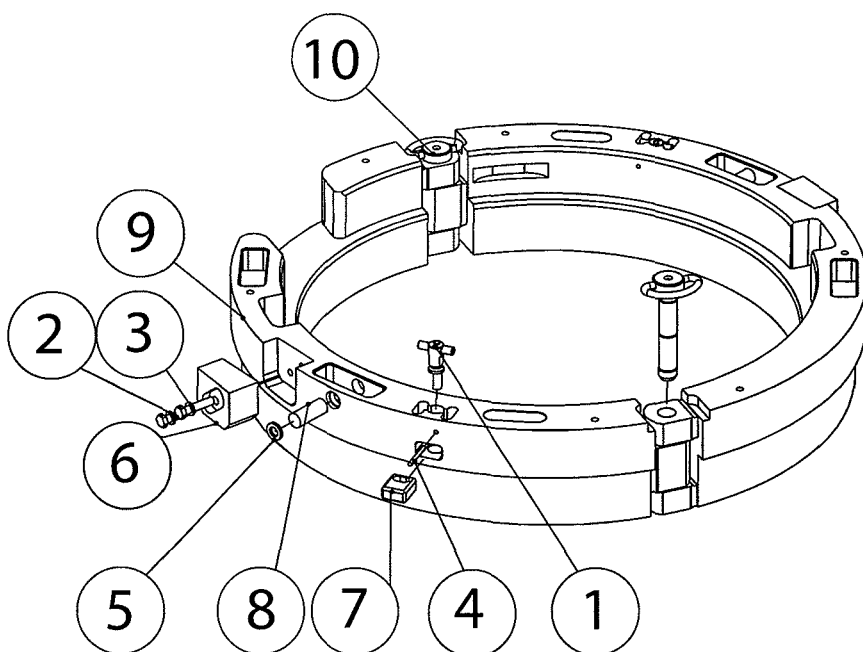
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50004994, 50004998 & 50004999



50004702-1, 50004703-1



50004704-1



PAPER TEST

PAPER TEST



NATIONAL OILWELL VARCO

TEST SPECIFICATION

Paper Test for verification of slip type tools

Fill in data for applicable parts (1 or 2).

1) Hand slips

Master bushing
Part number:.....
Serial number:.....
Insert bushing
Part number:.....
Serial number:.....
Slip set
Part number:.....
Serial number:.....

2) Slip type elevators, power slips, (flush mounted) spiders

Slip type elevator, power slip, (flush mounted) spider
Part number:.....
Serial number:.....
Slip set
Part number:.....
Serial number:.....

Verification date:.....

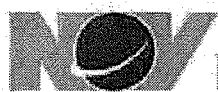
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Company:.....

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Name:	PGF	Name		
Date:	28 June 2007	Date		
Drawing type:	TS	ECN		
Varco BJ B.V. Nijverheidsweg 45 4879 AP Etten-Leur The Netherlands Tel: +31-76-5083000 Fax: +31-76-5046000	Revision: -	Document No.: TSEL-0158	Description: Inspection criteria for slip type tools	Sheet: 1 of 4

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Paper Test

This specification is designed to be used for verification of slip type tools.

General Notes

Before commencing a test, pls. take note of the following advisories:

- Clean the inserts by wire brush
- Clean the section of tubular/mandrill where no bite or insert marks exist
- Clean the slips and tool bore which are going to be inspected.
- Check for visible wear.
- Remove old grease / mud from the slip seat
- Lubricate the slip back and slip seat
- Ensure the load applied is 10,000 Lbs (4,535 kg) times the number of inserts columns.

Procedure verification hand slips

1. Wrap the test paper around the tubular. Use tape to fixate the paper.
2. Holding the slips by the handles, place the slips around the paper.
3. Lower the pipe and slips into the split bowl / master bushing.
4. Apply load (see calculation above)
5. Holding the slips together by the handles, raise the pipe and remove the slips.
6. Remove the paper and evaluate the markings as shown on the illustrations.
7. During steps 4 up to 6, scoring of the paper should be avoided.
8. If a full insert contact is indicated, the slip-bowl-system is in good condition. No further analysis is needed.

Full insert contact indicated?*

☐ OK

* If not, further analysis is required prior to using the equipment.

Procedure verification power slips, (flush mounted) spiders and slip type elevators

1. Wrap the test paper around the tubular. Use tape to fixate the paper.
2. Set the slips.
3. Apply load (see calculation above)
4. Release the load
5. Remove the paper and evaluate the markings as shown on the illustrations.
6. During steps 3 up to 5, scoring of the paper should be avoided.
7. If a full insert contact is indicated, the bore and the slips are in good condition. No further analysis is needed.

Full insert contact indicated?*

☐ OK

* If not, further analysis is required prior to using the equipment.

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Paper test acceptance criteria

L.H.-slip

C.-slip

R.H.-slip Top

Top

[illegible]

1. 100% contact acceptable

Bottom

L.H.-slip

C.-slip

R.H.-slip Top

Top

[illegible]

2. Run out of bottom dovetails (all segments) or worn bowl, bushing, elevator bore and or hinges. Not acceptable ($80\% < \text{contact} < 85\%$)

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R.H.-slip Top

[illegible]

3. About 80% contact most likely due to inserts worn, damaged or not made within the tolerances. This is NOT acceptable

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